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APRIL, 1963

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The Commission's purpose is to advise the participating Governments on ways of improving the well-being of the people of the Pacific island territories. It is concerned with health, economic and social matters. Its headquarters are at Noumea, New Caledonia.

The Commission consists of not more than ten Commissioners, two from each Government. It normally holds one session each year. There are two auxiliary bodies, the Research Council and the South Pacific Conference.

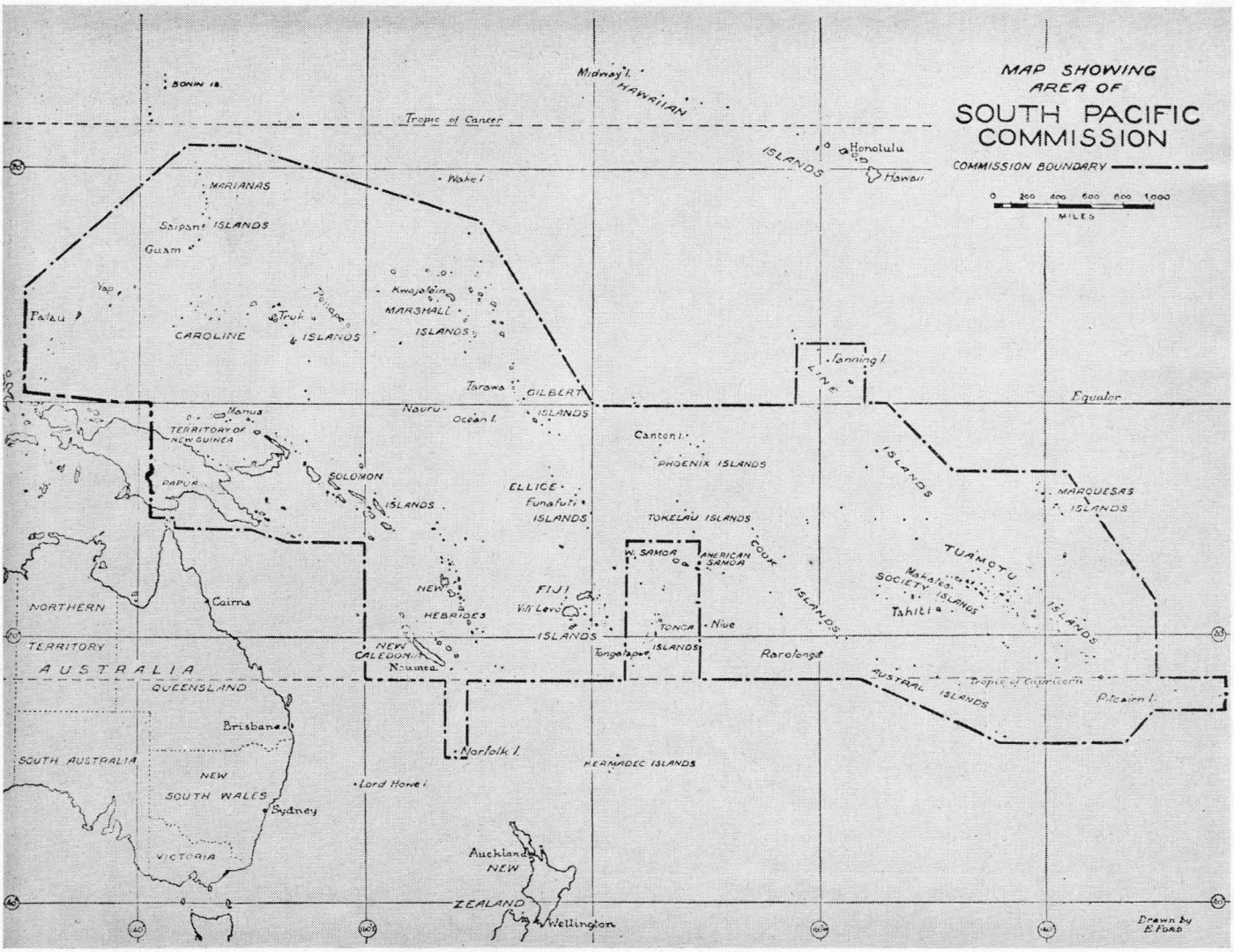
There is a Research Council meeting normally once a year. This may be either a meeting of the full Council, or of one or other of its three main sections, specialising in the fields of health, economic development and social development. Members of the Research Council are appointed by the Commission. They are selected for their special knowledge of the questions with which the Commission is concerned, and the problems of the territories in these fields. The chief function of the Research Council is to advise the Commission on what investigations are necessary and on the work programme. Arrangements to carry out those that are approved are the responsibility of the Secretary-General and other principal officers.

The South Pacific Conference, which meets at intervals not exceeding three years, consists of delegates from the local inhabitants of the territories, who may be accompanied by advisers. The first Conference was held in Fiji in April, 1950. The second Conference was held at Commission headquarters in April, 1953, the third in Fiji in April-May, 1956, the fourth in New Britain in April-May, 1959, and the fifth in Pago Pago, American Samoa, in July, 1962.

The principal officers of the Commission are: Secretary-General, Mr. W. D. Forsyth; Executive Officer for Social Development, Dr. Richard Seddon; Executive Officer for Economic Development, Dr. Jacques Barrau; Executive Officer for Health, Dr. Guy Loison. The powers and functions of the Deputy Chairman, Research Council, are exercised by the Secretary-General.

FRONT COVER PHOTOGRAPHS

Beetle-ravaged sago palms in the Markham Valley, near Lae, and (inset) the indigenous dynastid beetle responsible, **Oryctes centaurus**. Both photographs were taken by the Commission's entomologist, Dr. C. P. Hoyt, during recent rhinoceros beetle investigations he carried out in Papua and New Guinea. The habits and methods of attack of **Oryctes centaurus** on the sago palm are very similar to those of the related **Oryctes rhinoceros** on the coconut palm, and it was considered that a study of the former pest might provide information leading to control measures for the latter. (See article on page 20).



SOUTH PACIFIC BULLETIN

VOL. 13, No. 2 APRIL, 1963

CONTENTS

EDITOR: *A. E. Read, B.Sc.*

THE SOUTH PACIFIC BULLETIN, first published in January, 1951, features articles on selected activities in the Commission's three main fields of operation: economic development, health and social development. Articles are also contributed by specialists working in these and related fields, in the territories within the Commission area.

THE BULLETIN is given selective world distribution to people and institutions in widely differing fields sharing a common interest in the purposes and work of the Commission. It is published in two editions, English and French.

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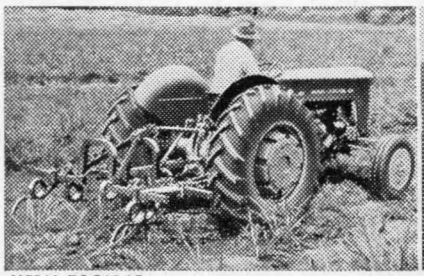

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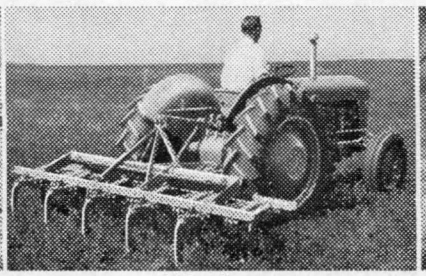

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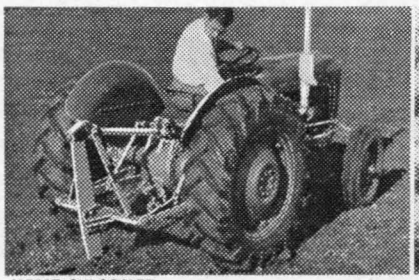

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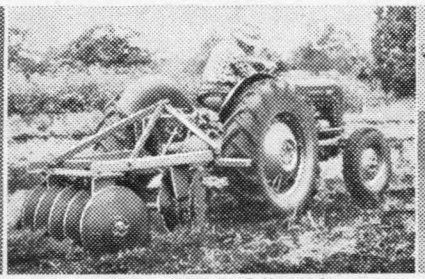

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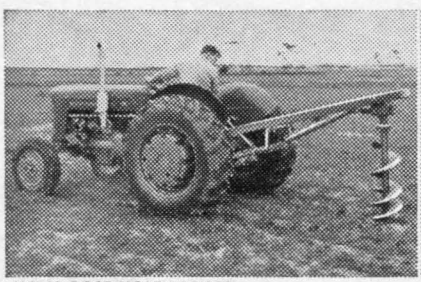

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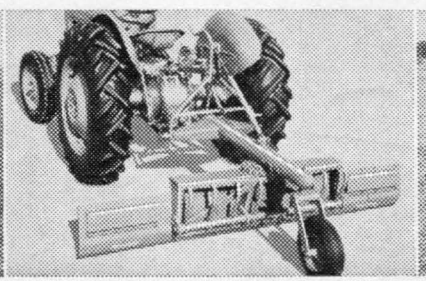

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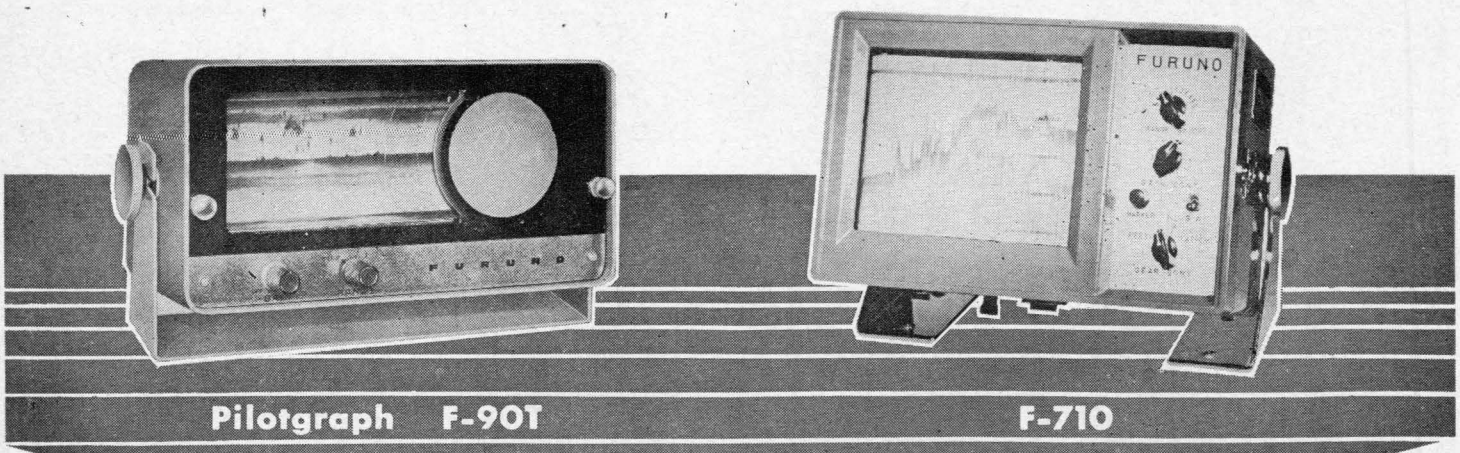

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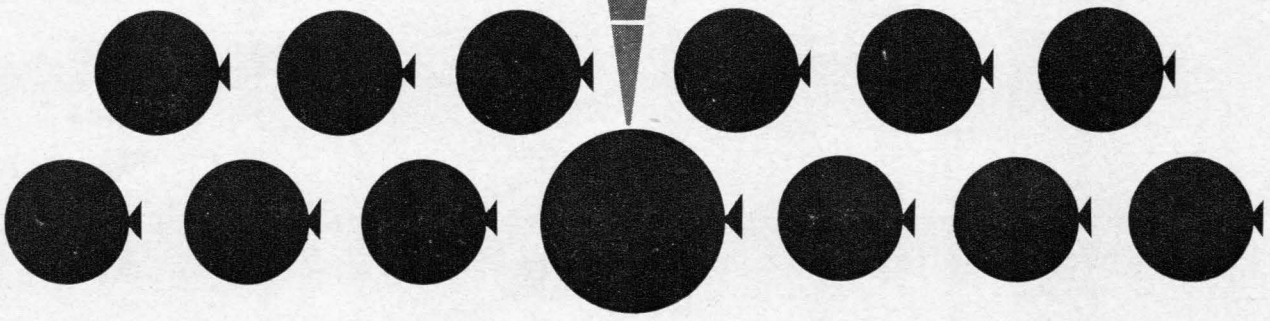

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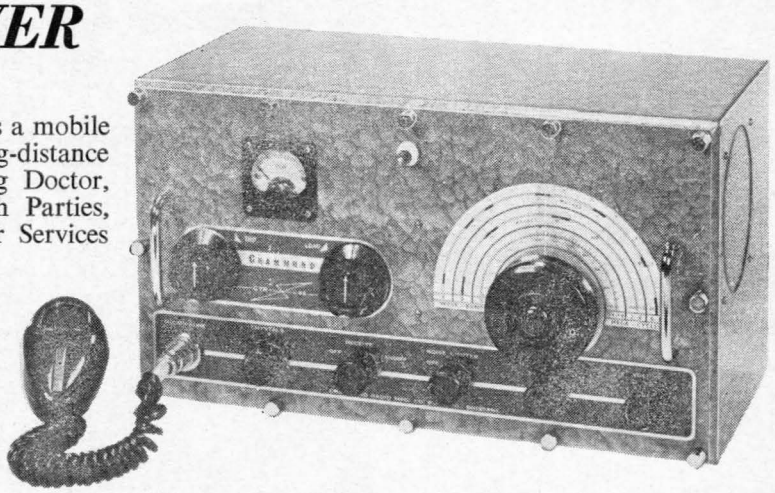

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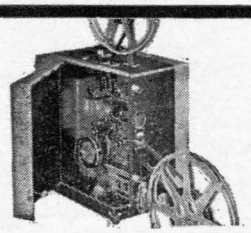

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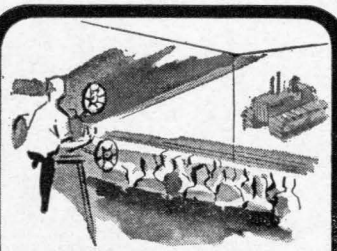

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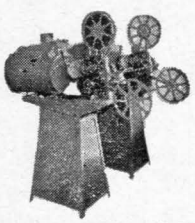

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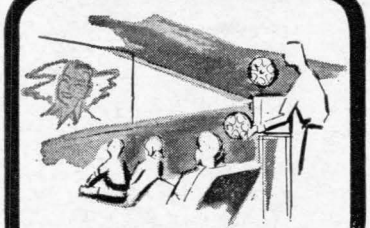

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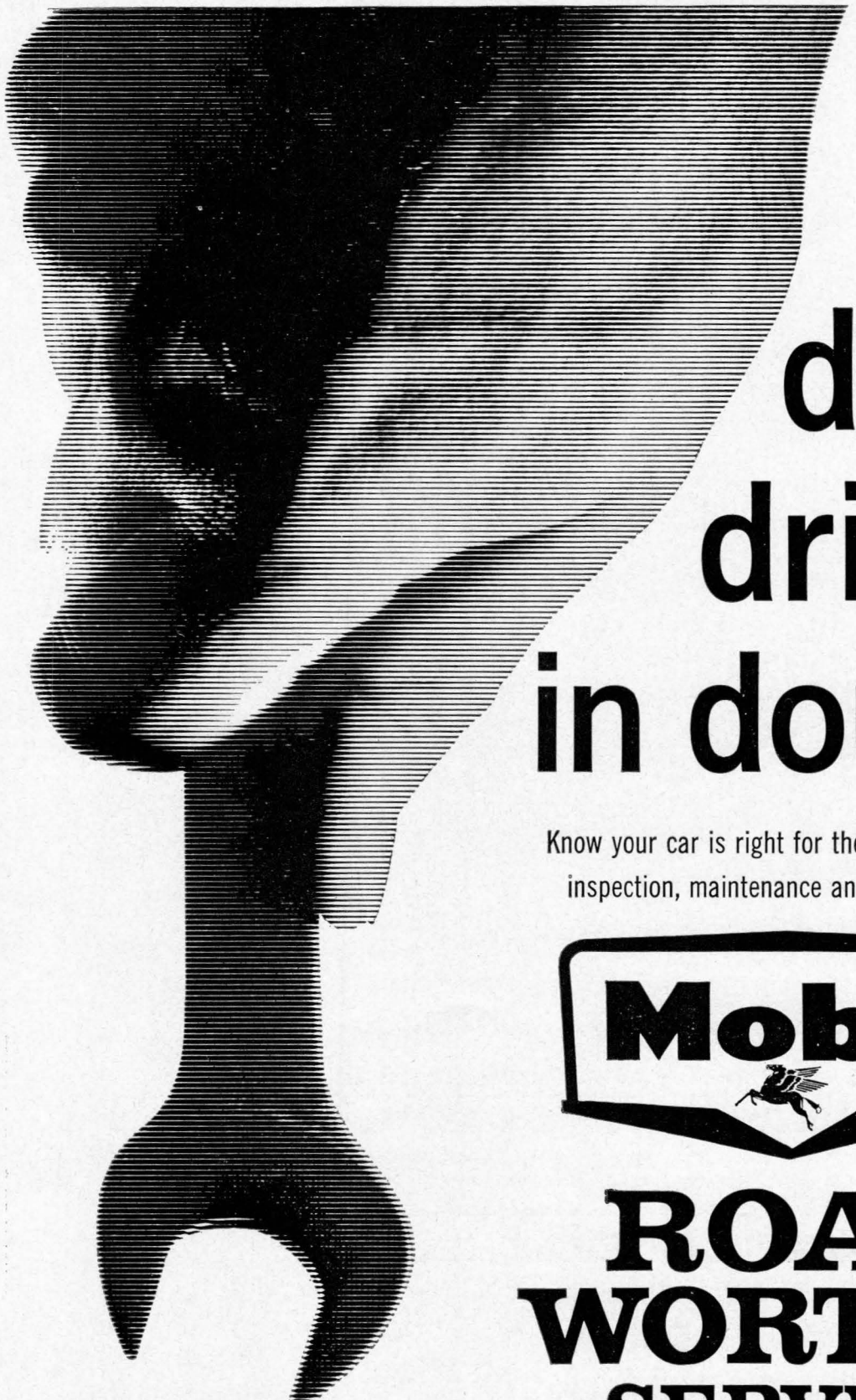

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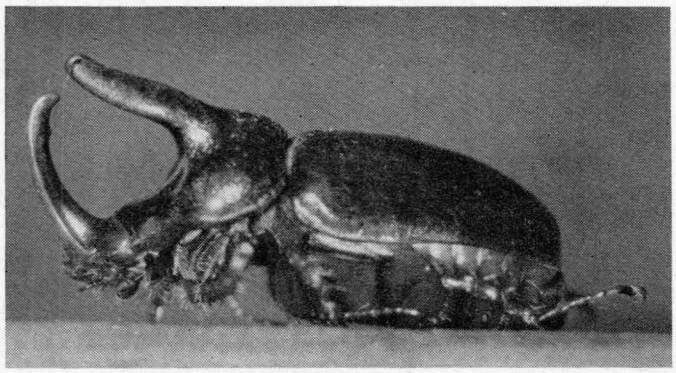
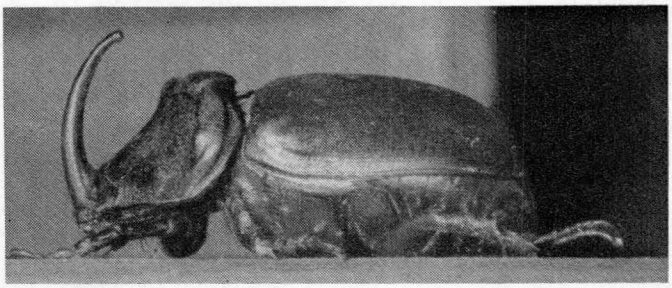
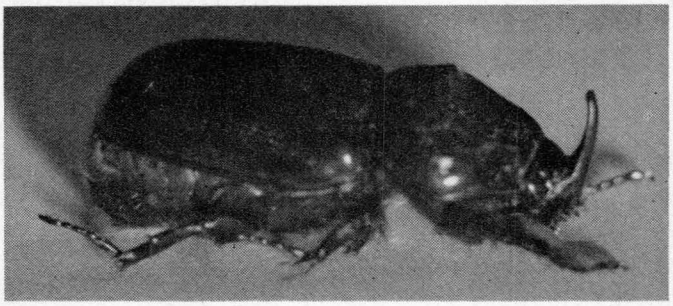






During Dr. Hoyt's investigations in Papua and New Guinea he collected and examined adult beetles of Scapanes australis (above), Oryctes centaurus (top right), and Oryctes rhinoceros (right).

Rhinoceros Beetle Investigations In Papua And New Guinea

The Commission's entomologist recently visited Papua and New Guinea to study various species of dynastid beetles occurring there, including the indigenous Oryctes centaurus, *which attacks the sago palms growing in the freshwater swamps along the New Guinea coast. He gives an account of his investigations in the following article.*

By C. P. HOYT

SOME time during World War II the coconut rhinoceros beetle, *Oryctes rhinoceros,* was accidentally introduced into the Gazelle Peninsula of New Britain. Here it became established and caused serious damage to the coconut palms. Some years later this beetle reached the island of New Ireland, and is now slowly increasing in numbers.

Fortunately, *Oryctes rhinoceros* has not yet reached the mainland of Papua and New Guinea. However, throughout the territory, both on the mainland as well as on the numerous island groups, the indigenous dynastid beetles of the genus *Scapanes* attack young coconut palms in much the same manner as does *O. rhinoceros,* and each year cause a considerable amount of damage to them.

Related Species Attacks Sago Palms

In the extensive fresh-water swamps along the coast of New Guinea there is found another species of dynastid beetle, *Oryctes centaurus,* which lives in the sago palms (*Metroxylon rumphii*) growing in these areas. *Oryctes centaurus* seldom attacks coconuts, but its habits and method of attack on the sago palms are very similar to those of the

Below: Sago palms in the Markham Valley, damaged by Oryctes centaurus. Right: Coconuts interplanted with cocoa. New Britain.

related *Oryctes rhinoceros* and *Scapanes*.

Because both *Oryctes centaurus* and its host palm are indigenous to New Guinea, it was thought that a study of this beetle and its environment might provide information which would be helpful in finding control measures for the other dynastids.

Sago palms reach a height of about 40′ after fifteen years of growth. A palm at this age produces a large terminal inflorescence, and after the seeds have matured on this, the palm dies. When the trunk of the dead palm begins to decay, the adult beetles of *O. centaurus* bore into the rotting wood and lay their eggs. The larvae of the beetles feed on the wood of the decaying trunk, complete their development, and a new generation of adults emerges and flies to nearby living palms on which they feed. The adult beetles bore into the crowns of these sago palms to consume the juices which are produced by the crushing of the tender tissues of the inner leaves and heart as the beetles chew their way through them.

In addition to the larvae and adults of *O. centaurus,* there were found within the rotting sago trunks, cetonid beetles and their larvae, centipedes, burrowing cockroaches, a few small carabid beetles, a snake, and, very rarely, a large monitor lizard (*Varanus*).

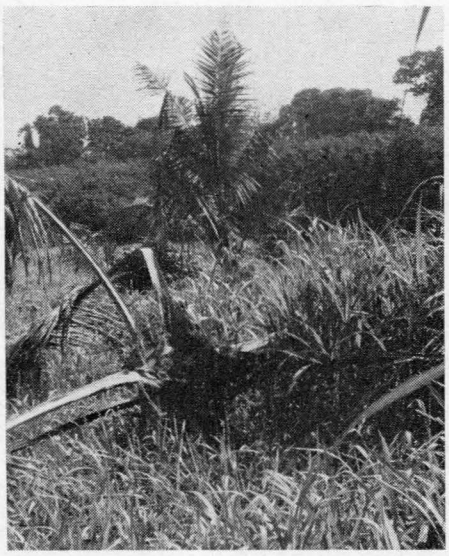
Parasitizing the cetonid larvae was a black *Scolia* wasp and a large, metallic-coloured tachinid fly (probably of the genus *Rutilia*). However, with the exception of the lizard which was found by the Department of Agriculture entomologist, Mr. John Ardley, nothing was present in these sites which showed any interest in the larvae of *Oryctes centaurus*.

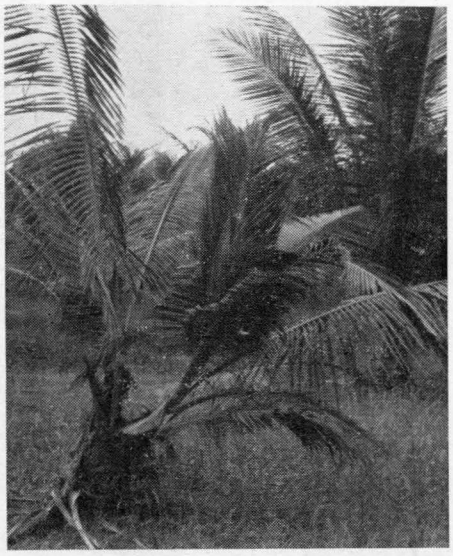
Nematode worms were found in the genital organs of the older adult beetles of *O. centaurus*. These worms were similar to those discovered infesting the same organs of *Oryctes monoceros* in East Africa last year by the author. However, two distinct species were present in *O. centaurus* instead of the single species in the East African rhinoceros beetle.

Adult beetles of *Oryctes rhinoceros, Scapanes australis,* and *Scapanes grossepunctatus* were collected and examined for nematodes and other internal parasites. Nothing was found in any of these species.

Recent Decline In O. Rhinoceros Population

It was interesting to note that the population of *Oryctes rhinoceros* had declined on the Gazelle Peninsula since 1955. From the distribution of the damage to coconut palms it appears that the decline in numbers may be due to the intensive inter-planting of coconut palms with cocoa which has now grown to produce a dense canopy over the ground and the fallen rotten logs which had served as breeding sites for the rhinoceros beetles. The logs in such places had few, if any, beetle larvae in them, while similar breeding sites in open areas were usually found to support large numbers of *Oryctes*.





Two views of damage to young coconut palms by Scapanes grossepunctatus. New Ireland.

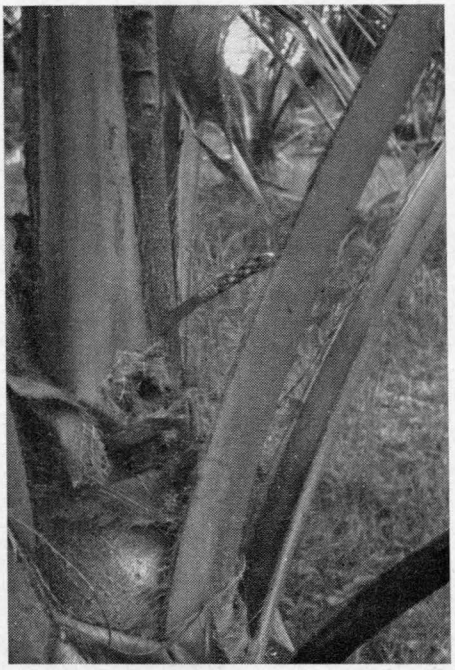
O. rhinoceros was found to be breeding in the trash accumulated in the crowns of oil palms planted on the Lowlands Agricultural Experiment Station at Keravat, and once in the bases of the fronds of a coconut palm. In New Ireland, the principal breeding site for this beetle is in the standing, rotten trunks of coconut palms, of which many appear to be the result of lightning strikes. *Scapanes* was found breeding in piles of rotten cocoa pod husks, and once underneath a rotten coconut log.

On the Gazelle Peninsula, *Scapanes* is seldom found damaging coconuts below about 400′ in elevation, but in New Ireland it occurs at sea level along with *Oryctes rhinoceros*. At present, in young palms along the coast one finds about three *Scapanes* adults to one *O. rhinoceros*. However, it is unusual to find both species attacking the same palm at the same time.

The two indigenous species of *Scapanes* usually confine their feeding to young coconut palms and seldom do any appreciable damage to trees over ten years of age. *Oryctes rhinoceros* probably does most of its damage to young palms, but does not hesitate to attack the older, mature trees. If it is present in large numbers, it can cause serious losses in stands of mature palms, a fact well known in places such as Samoa.

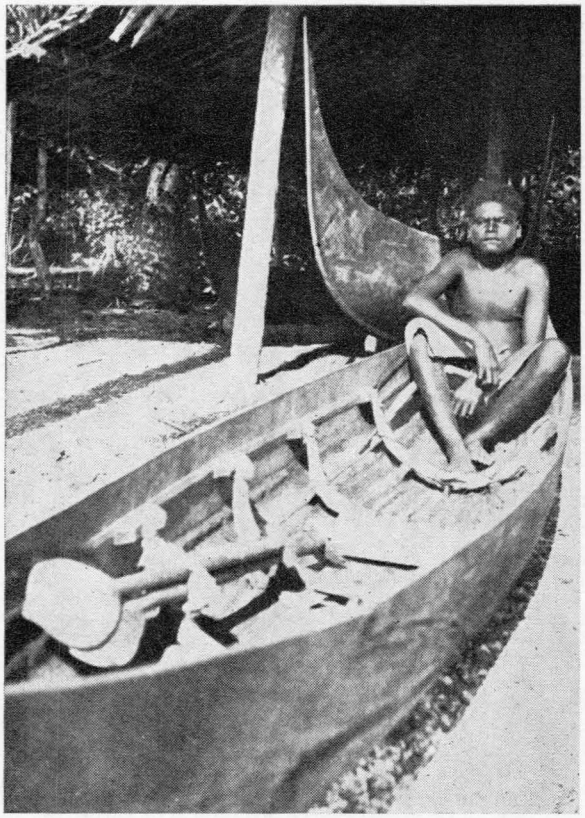
Clean Plantations Essential

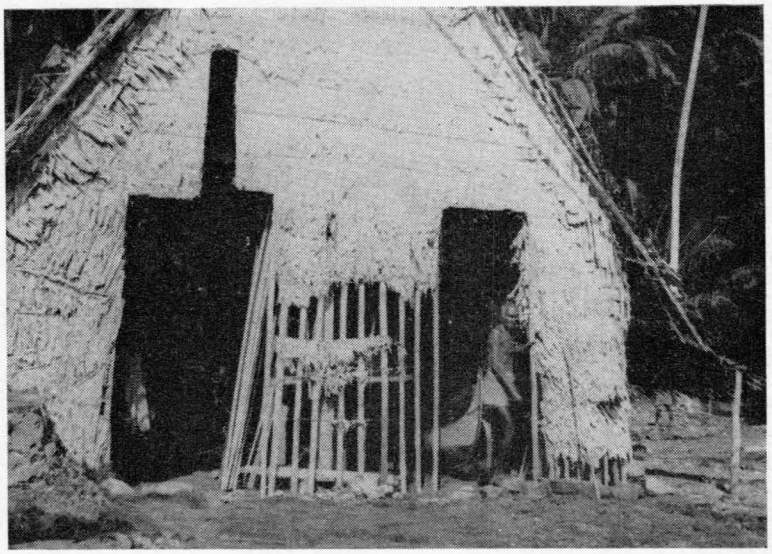
Regardless of how effective natural control agents are, the numbers of rhinoceros beetles in any area are going to depend on the number of suitable breeding sites available. A standing, rotten coconut palm trunk is a most suitable site for *Oryctes rhinoceros,* and a very large, old heap of rotting cocoa pod husks seems to be a suitable site for *Scapanes*.



Hole bored by Scapanes grossepunctatus at base of fronds of young palm.

The reduction of the numbers of such sites as these must take place if full advantage is to be gained from whatever biological control agents are introduced and established. Hence, even if the nematodes or adult beetle predators such as *Platymerus rhadamanthus* or larval parasites like *Scolia ruficornis* do in time turn out to be effective controlling agents, part of the solution to the problem will still depend on the management of the plantation by the planter.





Left: Interior view of a Vella Lavella, New Georgia, canoe, showing details of its construction. Note leaf-shaped paddles. Above: Canoe house with slot for high prow. Vella Lavella, New Georgia.

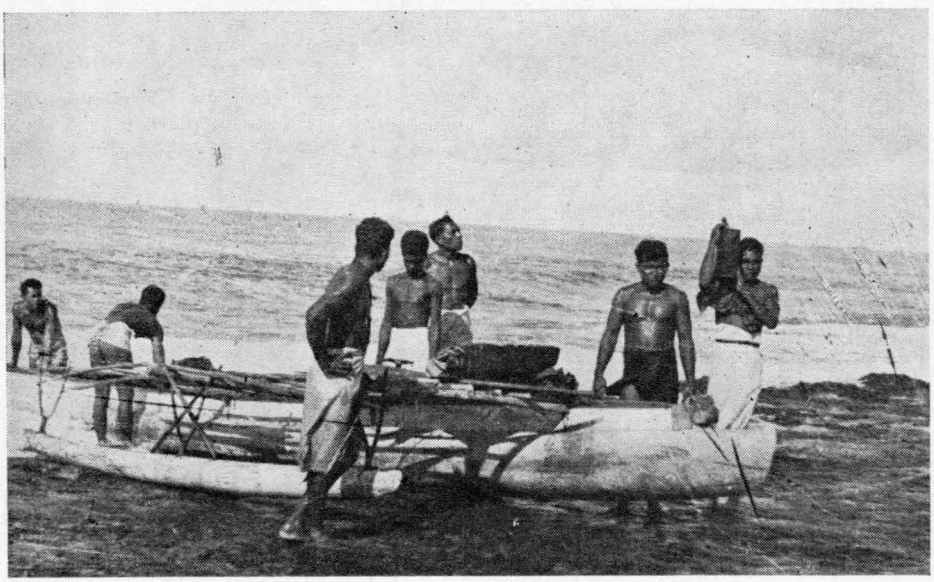
Canoes Of The Solomon Islands

Skill, enterprise and courage to a high degree were shown by the early Solomon Islanders in the building and sailing of their different types of canoes.

By R. J. A. W. LEVER*

WHILE much has been written about the canoes of the better-known islands of eastern Melanesia and of Polynesia (such as Fiji and Samoa), those of the lesser-known Solomon Islands are also most interesting, and well worthy of study.

The first Europeans to see these craft were the Spanish explorers under Mendana in 1568 and, thirty years later, Quiros. Afterwards came the British and French, including Carteret and Bougainville, and all were impressed by the beauty, craftsmanship and handling skill of these vessels produced by primitive Melanesians. When it is remembered that until comparatively recent times, all the laborious work—felling the trees, hollowing out the trunk, and making the planks—was carried out with stone or shell adzes, one cannot but be struck by the industry and skill of these people in their isolated island homes.



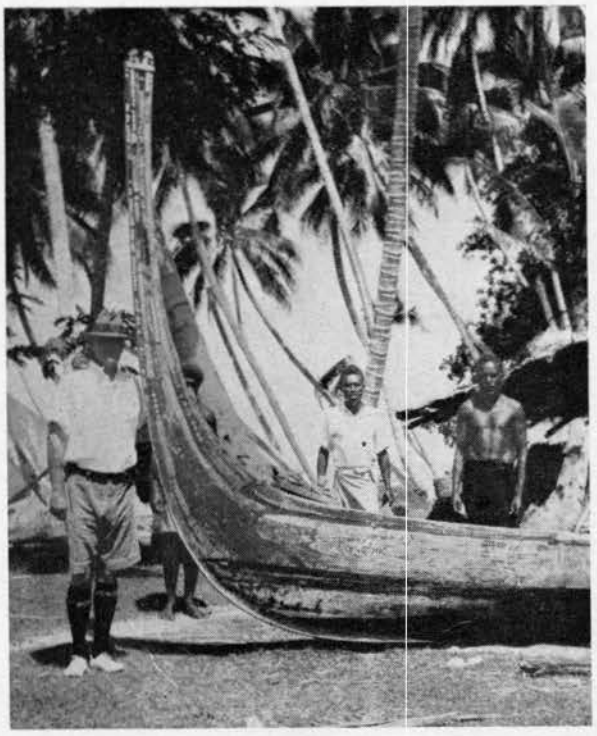
Canoes Usually Of Planked Construction

Although the single outrigger canoe is found in the Solomon Islands, the more usual craft had neither outrigger nor keel, and was made from neatly-fitting planks. The method involved the joining by means of vines or coconut fibre (sinnet) of a series of pierced planks which were rendered watertight with a native cement. This is made from the so-called putty nut (*Parinarium laurinum*), which gives a resin serving to caulk the seams. Although this soon hardens on exposure to the air, it will crack if left too long in the sun, and therefore canoes when not in use are kept in special canoe-houses,

Dugout canoe with outrigger on the coral reef of Sikaiana Atoll.

* The author was Government Entomologist in the Solomon Islands from 1931-37. He again visited the territory briefly in 1945, to study the control of mosquitoes by DDT.

Canoes of southern Malaita.



Prow of a New Georgia (or Roviana) canoe. Sometimes 12′ tall, these prows are decorated with fringes of cowrie shells.

in which ancestral skulls also used to be stored.

It is interesting to note that in Polynesia, where the putty nut is lacking, a substitute was found in the gum from breadfruit trees, plus bark cloth made from the paper mulberry tree.

When the outer hull has been completed, an inner framework is inserted and a series of projecting cleats or lugs on the planks are lashed and cemented to the frame, to give a strong and serviceable craft. This system of boat-building permits greater beam than is possible in a hollowed-out dugout, and also obviates the need for an outrigger.

The most admired canoes are built in the New Georgia area in the western part of the Protectorate. The tall prow and stern post are decorated with fringes of pierced cowries, while the hull is inlaid with a pattern of pearl shell depicting frigate birds, dolphins and various other designs.

Illustrations of these graceful canoes, which are somewhat comparable in workmanship to Viking longships, were chosen for the first postage stamps issued in the Protectorate. In fact, the prow of a Roviana canoe features in the current 2½d issue.

Some of these vessels, which could hold up to thirty-five men, had a length of over 55′, a beam of 4′ to 5′, and prows and stern posts 12′ high.

Most Valuable Tribal Possession

In former times the canoe was the most important single tribal possession, and its building was carried out by expert craftsmen who were virtually specialists in this field. During the construction and especially the launching, women were strictly banned. They were also forbidden to travel on the maiden voyage.

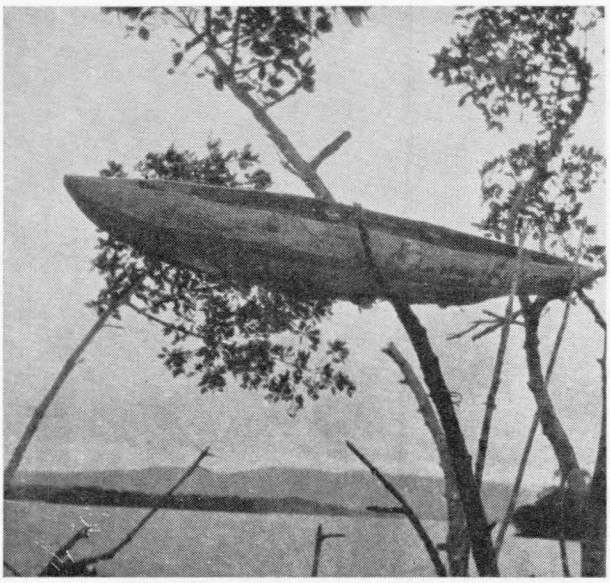
Up to sixty or seventy years ago, human sacrifices were made at the actual launching ceremony, at which prayers were made to the particular guardian spirit chosen to look after the fortunes of the craft on long voyages or on fishing expeditions.

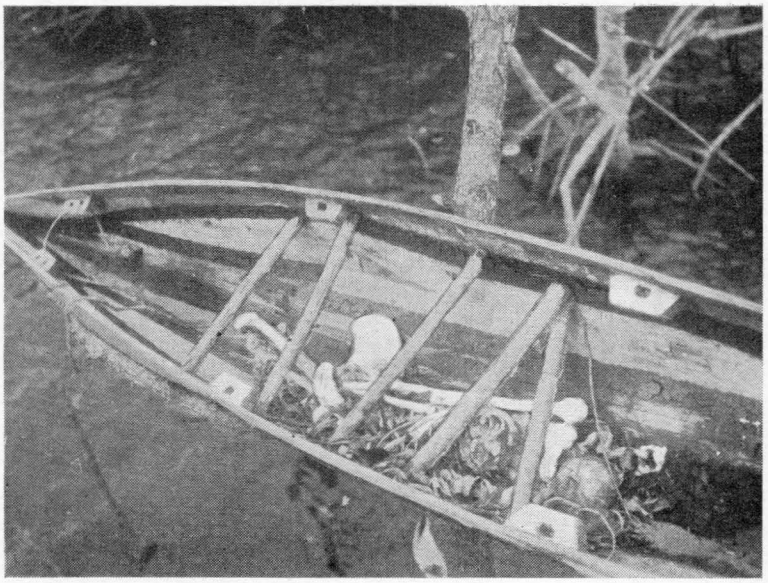
There is a good deal of variation both in shape and construction among the various islands, so that although canoes from Malaita and Guadalcanal are attractive, they have less elegance and a more box-like appearance than the more graceful lines of those from New Georgia, known by their native name of *tomako*.

Lying well away from the main double chain of the Solomon Archipelago are a number of small islands inhabited by Polynesians. Two of these are Sikaiana and Ontong Java, lying respectively to the north and north-east. As will be seen from the photographs, the canoes of the former are of the dugout type, with outriggers supported by booms arranged in three catapult-like structures. The average length of the hull of Sikaiana canoes is about 30′.

As showing the common origin of the different present-day Polynesians, the writer sent the names of some constituent parts of Sikaiana canoes to the late Sir Peter Buck of the Bishop Museum, Honolulu. In his reply the famous Polynesian scholar kindly gave the Samoan equivalents of these words. Allowing for the fact that Sikaiana nouns are always given with the prefix *te* (meaning "the"),

Women in a Malaita canoe. Note narrow-pointed paddles, and built-up gunwales at each end.





This canoe in a mangrove tree contains human hip and long bones, shown in the picture at right. The skull has been taken to a skull-house.

the names were almost identical. Thus, the outrigger is *teama* in Sikaiana and *ama* in Samoa. The corresponding words for the hold are *teliu* and *liu,* and for the keel, *tegele* and *ta'ele*—a wonderful similarity for two groups of islands over 1,600 miles apart.

Canoes Of The Santa Cruz Group

Lying still further eastwards, and to the north of the New Hebrides, is the Santa Cruz Group, where again one finds the dugout type with not only the outrigger but a platform on the opposite side on which are kept cargo and food (and in former times, weapons). These canoes were admired by the Spanish explorer Quiros, who found that the larger vessels (*tepukei*) made very long voyages to other islands. At the time of his visit all the construction had to be laboriously carried out by adzes made from the giant clam or from stone.

The larger canoes often have a shelter made of wood covered with palm leaves as protection against the glare of the sun. (It is worth mentioning here that Sikaiana and Santa Cruz are among the very few places in Melanesia where weaving is carried out on native looms).

In addition to their usual function, canoes in the Solomons are sometimes used as coffins. Two of the accompanying photographs illustrate this usage on Malaita.

Wide Variation In Paddle Shapes

Even in such a short account as this, one cannot omit the different paddles used by Solomon Islanders. They vary from being leaf-shaped, and quite pointed, to broad with rounded ends. The handle is often provided with a "T"-shaped or crutch-like grip, useful for powerful down strokes.

The bailer—so welcome in heavy seas—varies in design and material, being made from coconut spathe, coconut shell, leaf-base of other palms, or leaves of the versatile pandanus or screw pine.

Courageous Seamen

To anyone who has, like the writer, travelled in all weathers in the notoriously unpredictable seas of the Solomons, it is easy to appreciate from one's sturdy schooner or ketch just what the Solomon Islander has to face in his open canoe. While voyages of over fifty miles are admittedly rare nowadays, yet the sudden rain squall blotting out all landmarks and giving rise to a very choppy sea makes one realize that the Melanesians of old must have been a stout-hearted race.

Certainly their voyages were short when compared with the more adventurous Polynesians, but they must not on that account be looked upon as fair-weather sailors who always hugged the coast. Canoes are always liable to be blown many miles off course. In one such instance in 1936, a canoe from the Louisiade-Trobriand Archipelago (off S.E. New Guinea) was blown ashore with its occupants at Vella Lavella. Had the currents and wind taken it further south it would not have encountered land before fetching up in the New Hebrides over 700 miles away.

Over the course of centuries, such accidental dispersal must have accounted for the peopling of many of the islands of the Pacific.

SPC Handicrafts Survey Of South Pacific

On January 12 Mr. Angus McBean, SPC social development assistant, left Commission headquarters in Nouméa for Wallis and Futuna Islands, where he began carrying out the first part of a regional survey of Pacific handicraft industries.

The South Pacific Commission decided at its session held last October that this survey should be made as a first step towards fostering and revising handicraft industries in the many territories of the region where they have long been a main source of income, and as well have maintained pride in cultural traditions and skills.

Following his visit to Wallis and Futuna Islands from January 13-28, Mr. McBean proceeded via Fiji to the Gilbert and Ellice Islands. From there his programme extends to the British Solomon Islands Protectorate for about four weeks in March-April, Papua and New Guinea in April-May, and return to headquarters about mid-May. Visits to Fiji and Western Samoa will be made about June-July. On the basis of his report the Commission will later consider the possibility of establishing a handicrafts centre to promote the sales of handicrafts in metropolitan countries for the whole region.

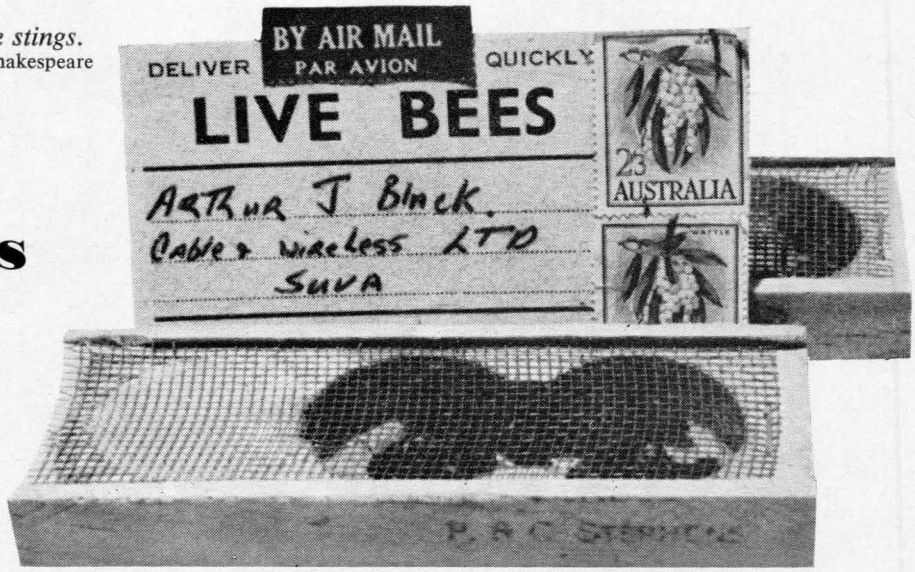
Mr. McBean is well qualified to carry out the survey on which he is now engaged. Before joining the Commission in late 1961 he was headmaster of Niue High School, and it was at his suggestion that the Niue Weavers' Association was formed early in 1960. While on leave in New Zealand he obtained from a Christchurch retail store the first order received by the Association—for £300 worth of assorted woven and plaited ware.

He is not worthy of the honeycomb
Who shuns the hive because the bees have stings.
—Shakespeare

Beekeeping In The Tropics

The author of this article hopes that his enthusiasm for a most absorbing and rewarding hobby will encourage the extension of amateur beekeeping throughout the islands of the South Pacific.

By ARTHUR J. BLACK*



A queen bee arrives in Suva by air from Australia, attended by ten worker bees. Candy in the round compartment on the left provides food for the journey.

MY introduction to beekeeping took place soon after I arrived in Suva in 1955, when I met a retired professional apiarist from Sydney who was holidaying in Fiji. In talking to him, I wondered how bees would do in my garden. His reaction to that question was, within a few days, to draw my attention to a paragraph in the *Fiji Times* stating that a swarm of bees had settled in the garage of a bungalow in Suva, and inviting anybody interested to remove them.

He then told me of the principles and dimensions of a beehive and movable frames. I spent the weekend making them, and on the Monday afternoon went to watch the "hiving".

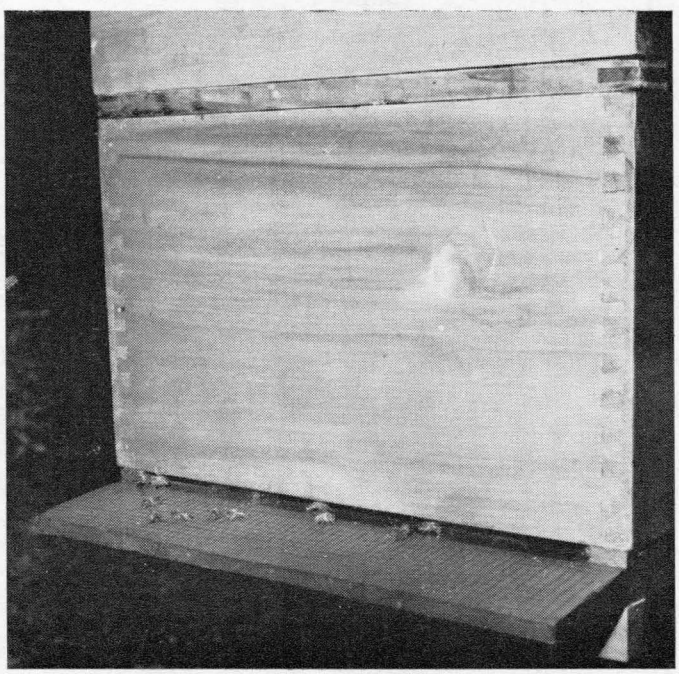
I had never been near bees before, but the apiarist, by moving slowly among them, quietening them with the smoke from his lighted cigarette, gradually cut the honeycomb and adhering bees away from the shed rafters and placed the comb into the hive. As soon as the queen bee had been placed in the hive, he brushed the remaining bees to the ground and they marched in to join her.

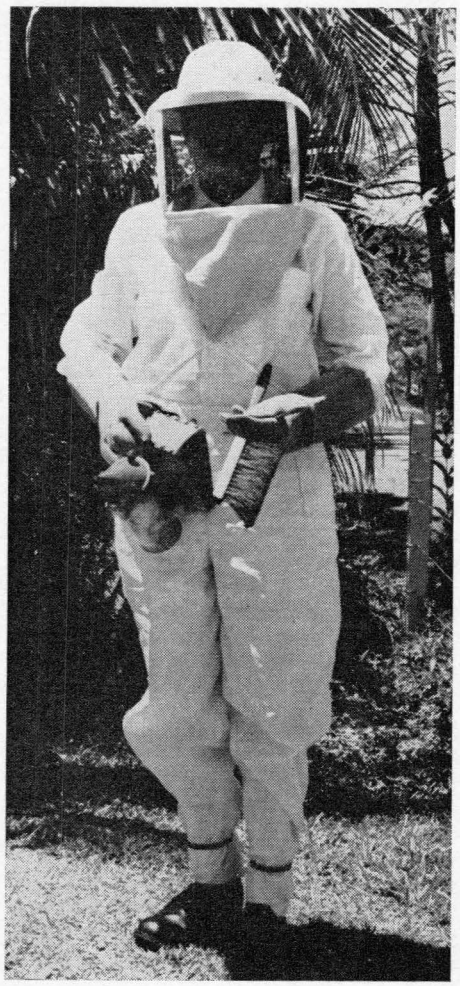
During the process the bees were flying round us in great numbers and I was cautioned not to move, although I was quite fearful throughout. However, none became angry enough to sting either of us.

The hive was left until dark, when it was transferred to my garden. I then

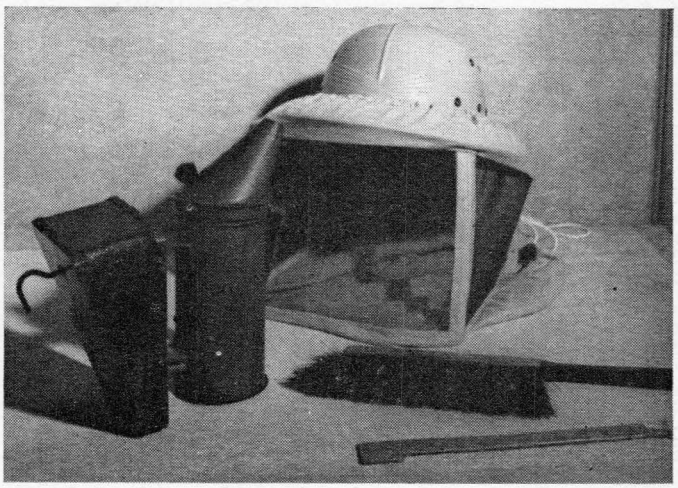
* Mr. Black was Manager of Cable and Wireless, Suva, Fiji, from September 1955 to September 1962. He established his first apiary in the extensive grounds of the Company's bungalow in Williamson Road, Suva, opposite Albert Park and adjacent to the Botanical Gardens.

Left: The beehive. The lower section is the brood nest, and the upper, the honey 'super'. The hive is mounted on a platform as protection against toads and ants. Below: Close-up of alighting board and hive entrance.





The author dressed to manipulate bees. Note wire-mesh veil, gloves, boots and gaiters. An angry bee will find the smallest aperture, even the ventilation hole in a tropical helmet.



The beekeeper's tools are the smoker, bee brush, and hive tool.

proceeded to study the bees, and found for myself an absorbing hobby. Among other things, I discovered that honey produced within the City of Suva is as delicious as any I have ever tasted.

History Of The Bee

The history of the honey bee is as old as the human race, for, since the days of the caveman, we have been robbing the bee of its honey.

Until the introduction of sugar-cane into the Middle East from India around the seventh century A.D., the honey bee was the only source of sugar known to man.

In the Scriptures, "honey" and "milk" are often linked to form the Oriental metaphor denoting abundance—"a land flowing with milk and honey". These words are used in twenty passages of Scripture, from Moses down to the prophet Ezekiel, to describe the country promised to the descendants of Jacob. In all, there are sixty-eight references in the Holy Bible to honey bees.

Aristotle described honey as being distilled from the stars and the rainbow.

Since the seventeenth century much attention has been given to the study of the honey bee. Thus, in middle Europe the researches of Dr. Zierzon, a Roman Catholic priest, established the theory of parthenogenesis, while Huber, a blind Swiss, with the assistance of his servant Burnens, established much of our knowledge of bee behaviour.

The art of modern beekeeping began in Ohio, U.S.A., when another man of the cloth, Dr. L. L. Langstroth, in 1845 revolutionized beekeeping by invention of the movable frame hive. His invention was based on his discovery that bees left a space of approximately five-sixteenths of an inch between their combs, and he took advantage of this fact. Two other most important discoveries about the same time were those of the invention of comb foundation, and extraction of honey by whirling the combs in a centrifuge.

Commercial beekeeping as it is practised today was developed from these three inventions.

Formerly, the honey was obtained by destruction of the bees, by smoking them with sulphur.

Value Of Bees For Pollination

Of the pollinating insects, the honey bee is the only one under the control of man. Its value to agriculture is inestimable. Orchardists and growers of seed find that by placing bee colonies in their properties at flowering time, the yields may be increased by approximately five-fold.

American bee literature states that for every dollar obtained in honey, fifteen dollars is obtained in value by better pollination.

Bees In Fiji

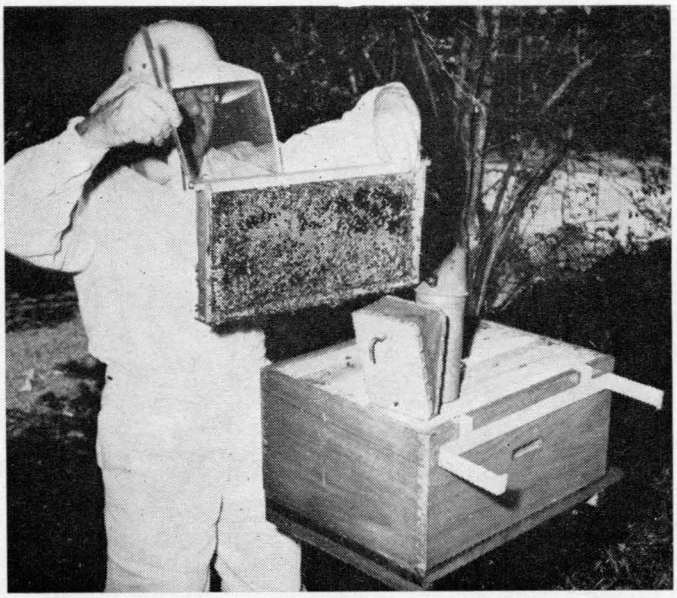
Bees were introduced into Australia by Captain Wallis in the ship ISABELLA in April 1822, and into New Zealand by the daughter of a missionary, a Miss Bumby, from the ship JAMES in 1839. I have not been able to discover when they were introduced into Fiji, but I have no doubt they came from either Australia or New Zealand.

There are more bees about Suva—which is as far as my knowledge goes—than we are able to appreciate. There are many colonies in the walls of wooden houses. Their value would be greater than their nuisance value, from the point of view of pollination.

The bees in Suva are black in colour, which would confirm the fact that they came from Australia or New Zealand, for the original importations to those countries were black bees from England.

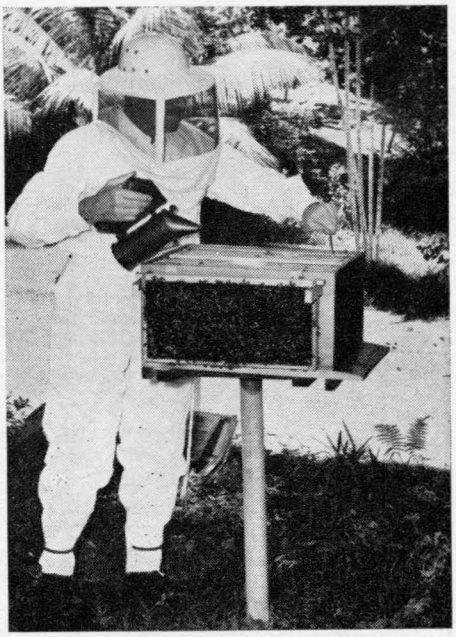
The bee favoured by the commercial apiarist is the Italian bee, known for its comparative gentleness, and—being of a yellow colour—from three yellow bands on its abdomen. I have imported Italian queen bees from Sydney and my bees have the yellow colouring. At present

Opening the hive. A gentle puff or two of smoke, slow movements, and no jolting, ensure that the bees will remain docile.



Left: First frame removed from hive. No angry bees.

Right: Removing the second frame. The first has been hung on the bracket attached to the side of the hive (see picture on left).



Right, below: Removing the third frame. Still no angry bees.

they are not altogether of Italian breeding, for the queens are descendants of those I imported, mated by local black drones.

The Beehive

In the old days of beekeeping the hive was of straw, of the familiar beehive pattern. Modern hives are of standard size, and the frames which contain the honeycomb are also of standard size and design.

The beekeeper so organizes his hives that the bee-brood—that is, the nest in which the eggs are laid and the bees brought to maturity—is in one portion of the colony, while the honey is produced in another section, for ready removal and extraction.

From experience gained by experiment I had to set my hives a certain height above the ground. Fiji toads love bees, and they congregate about the colonies at dusk waiting for the bees to remove their dead, which they do at night by carrying them to the hive entrance and pushing them overboard. The toads, I found, could jump to a height of over a foot to the alighting board of the hive, where they used to sit and gobble up the bees, both alive and dead, as they emerged from the hive. I found that a useful distance of the floorboard from the ground is 2′ 3″.

Ants are also fond of honey, so I had to devise a means of preventing their entry to the hive. This I did by setting the hives up on a platform supported by a piece of waterpipe set in a block of concrete.

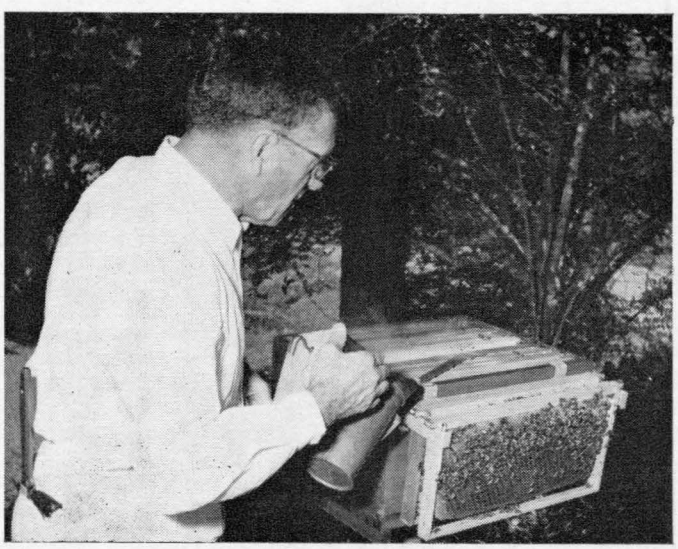
The Honeycomb

The honeycomb, which is manufactured by the bees from wax exuded from their bodies, is of most remarkable structure. In design it is the mechanical figure which is most economical of material and space, that is, the hexagon. The comb consists of a central rib of wax, with hexagon-shaped cells on either side of the rib, slightly inclined to contain honey. The thickness of the wax in the cell walls is the minimum possible to contain honey or brood, asserted to be one three-hundredth of an inch. There are twenty-seven worker cells to the square inch, the size of the cells being nearly the same the world over.

When the first Republic of France inaugurated the decimal system, Reaumur (of thermometer fame), who was a prominent worker with bees, proposed to take worker cells as the standard for the system. However, it was found that they are not exactly uniform in size.

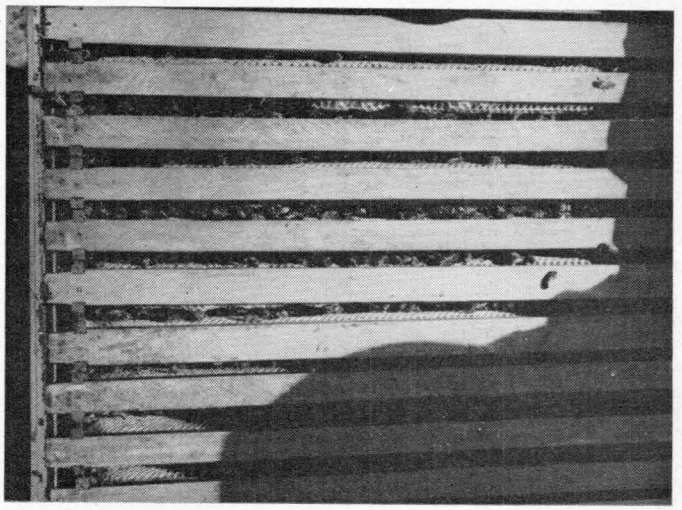
Honeycomb will last for many years, if properly cared for. When first made it is pure white, but with use, which involves spinning of cocoons by pupa, the comb becomes very dark in colour.

Beeswax has many applications in art and commerce. It is used largely in the



Helmet and veil removed, for closer inspection.

Close-up of a frame.



Looking down on a ten-frame hive.

manufacture of candles for ecclesiastical use; is the basis of most cosmetics; is still a very valuable electrical insulator; and has many uses in dentistry and pharmacy.

The Occupants Of The Hive

The occupants of the hive consist of one queen bee, some thirty or more thousand worker bees, and from a few to several hundred drones. The queen bee is the only perfect female in the colony. She lives for two or three years, and during her life she is capable of laying eggs continuously.

The worker bees are incomplete females, which do all the work of the hive, their various duties being carried out according to their ages. The drones are male bees, and their only job of work is to be around when the virgin queen emerges from the hive on her nuptial flight, when one of them fertilizes her.

The Queen Bee

The queen bee is produced by the hive when the need arises. The reigning queen is acceptable to the bees for perhaps two years. When she is failing in egg production the hive decides to supersede her, or, in the case of great prosperity of the hive, it decides that a swarm should emerge. In either case, worker larvae two or three days old are encased in specially-shaped cells, called queen cells, and are fed on royal jelly. Ten days later they emerge.

In the case of supersedure, the first queen to emerge immediately kills the remainder of the queens as they are born. Within seven days she emerges from the hive on her nuptial flight and mates with a drone high in the air. Within a few days she is ready to commence laying, and usually the worker bees kill the old queen, by suffocation. However, if the plan of the hive is to swarm, the old queen emerges with the swarm to form another colony.

Swarms emerge on sunny days about ten in the morning. The swarming hive is a most wonderful spectacle. For some fifteen minutes the air within a hundred yards of the hive is literally full of excited bees. They spend from fifteen to twenty minutes in their manoeuvring, and then alight on a branch of a tree or a shrub in a great mass for an indefinite time—perhaps a few hours—while they further organize themselves. During this period scout bees from the swarm are searching the district in an endeavour to find a suitable place to direct the swarm so that it may settle permanently. At the proper time the scouts will lead the swarm to its new home.

If in the meantime the apiarist wishes to hive the swarm, he does so by bringing up his empty hive, placing it near the swarm, and then brushing the bees into or toward the entrance. When the queen bee has been placed in the hive, or has found her way into it, the remainder will then march in, just like an army. This also is a wonderful spectacle. Then, at dusk, the hive is placed in its permanent position in the apiary, and so commences its new life.

The Worker Bee

The worker bees are born within twenty days of the laying of the eggs. Their duties are multitudinous. Their lives are divided into three periods. Their first duties on emerging from their cells are cleaning out and polishing cells in the honeycomb for reception of eggs laid by the queen. This they do for two days. Next they commence feeding the older larvae with honey and pollen. Then, from their sixth to their fifteenth day, they feed the younger larvae. That completes the first period of their lives.

On the sixteenth day they take their first flight in the middle of the day. They fly in ever-widening circles, memorizing the position of the hive. During the remainder of these days they receive and store nectar from the foraging bees, attend to pollen brought in, and act as general workers in the hive.

Bees of this age secrete beeswax for making the honeycomb. They also assist in maintaining the temperature of the hive by their own form of air conditioning. Nectar when gathered is watery, and before it becomes honey has to be reduced to very much less than its original volume—even occasionally to one-fifth. To do this a group of bees gathers at one side of the entrance to the hive and another at the other side. They buzz back and forth beating their wings. What they are doing is creating a current of air which flows through the hive; the bees on one side driving in fresh air and those on the other side forcing the moist heated air out. After the day's work of nectar gathering is done, the bees operate this amazing ventilation system until the honey is fully dehydrated.

A single bee can carry a quarter to a half of its own weight in nectar. As a bee weighs less than one five-thousandth of a pound, a tremendous effort goes into the gathering of one pound of nectar. As this has then to be very considerably reduced in volume to make honey, it can be seen that many thousands of bees work mightily to make one pound of honey. In one trip away from the hive, a bee may visit as many as six hundred flowers.

The third period in the worker's life is from twenty to thirty days' duration in the summer months in temperate climates when she is active in the field foraging for water, pollen and nectar. The life of the worker bee is two or three months, when she dies from hard work, or perhaps misadventure.

The Drone

The male bees or drones, which are readily distinguished from the workers by their greater size, do not perform any duties within the hive and are barely able to feed themselves, but depend upon the workers to give them food. Their one function in life is to mate with the virgin queen when on her nuptial flight. For this purpose they are supported in some numbers by prosperous colonies during the summer months, but at the end of the season the behaviour of the workers toward them undergoes a change. One day they leave the hive as usual for their daily flight but are prevented by the workers from re-entering the hive, with the result that they quickly succumb to hunger and/or cold.

An observation hive, for the closer study of bees. The entrance is at roof height, access for the bees being via the glass-fronted passage to the right of the hive.

Honey Production

From the beginning of time man has found a way to make the honey bee produce more honey than it requires. Since the introduction of movable frame hives the production of honey has been a commercial proposition. The professional apiarist reckons on collecting a quantity of from 75 to 120 pounds of honey per annum from each hive. The professionals often practise hive migration, transporting them by large trucks from point to point as the honey flow occurs.

In Australia the honey crop is obtained largely from the eucalypts, while in New Zealand the principal source of honey is clover. There are, of course, special honeys such as the Scottish heather honey and the New Zealand manuka honey. There are, I believe, apiarists in the United States who will supply honey of many flavours, such as orange, mesquite, clover, raspberry, blueberry, and even coffee honey from Mexico.

When I was on leave in Sydney recently I saw my professional apiarist friend in his establishment, and he gave me a sample from each of five drums of honey. They were blackberry, Patterson's Curse, yellow box, clover, and the fifth was gathered when two sources were available, a eucalypt and clover.

A Valuable Food

Honey is a valuable food, and probably no other equals the rapidity with which it raises a lowered blood sugar count. The ancient Greeks well knew this, and their athletes gorged themselves on honey for weeks prior to the Olympic Games. In Western Australia, the honey producers advertise "Athletes' Drink", which is honey diluted by water.

Honey is still the only sweet available in pre-digested form, its principal ingredients being sucrose and levulose and dextrose. It is on record that it will sober up an alcoholic, the explanation being that its fruit sugar content, when it reaches the bloodstream, reduces its alcoholic content.

The sources of most nectar in Suva are, from my observations, the flower of the royal palm, antigonon, coconut, "mile-a-minute" and the mangrove. However, doubtless the bees visit many other flowers.

Manipulation Of The Honey Bee

The honey bee is readily manipulated by the use of smoke, of which it has a traditional fear. The apiarist should wear protective clothing, particularly a net, which should be worn with a hat, and should be capable of completely excluding all bees. Until one becomes used to handling bees, and by virtue of familiarity is able to move among them and manipulate them without fear, the protective clothing should be such that it is impossible for a bee to find a point to enter and sting.

One soon becomes used to an occasional sting, and there are very few people who are really allergic to bee venom. Indeed, there is a theory that the sting of the bee is an assurance against rheumatism. Beekeepers are traditionally healthy people, either from their outdoor activities or as a result of bee stings over the years.

The smoke is produced from smouldering sacking, dried leaves or pine needles, contained in a funnel-shaped barrel equipped with bellows.

Getting Started

There are colonies of bees in most areas, but in any case it is possible in these days to have bees flown into the Pacific region.

The Government of Fiji requires a Certificate of Health to accompany bees. They may be obtained in package form, that is, one or two pounds of bees in a wire gauze package, with the queen and her attendants in a small box within it. Alternatively, if bees are available, queens—each accompanied by ten worker bees as attendants—may be flown in in small boxes the size of a matchbox.

Beekeeping equipment—hives, frames, veils, smokers, honey extractors, and the minutiae of the beekeeper—may be obtained from suppliers whose names may be obtained from any Department of Agriculture. Costs of bees and materials are not high.

Literature

There is a wealth of literature on the art of beekeeping, the latest book on the subject being *Beekeeping in the Tropics,* published in the Tropical Agricultural Series. It was written by F. G. Smith, recently of Tanganyika and now in Western Australia.

The Departments of Agriculture in Australia, New Zealand, the United States, and the United Kingdom publish booklets and pamphlets which are supplied readily on application. The pamphlets are gratis, and the booklets are sold at nominal prices.

* * *

It is my hope that the foregoing will encourage some residents of the South Pacific to adopt the rather wonderful hobby of beekeeping. Indeed, already several people in Fiji have become enthusiastic beekeepers under my sponsorship.

123 Islands Students Study In New Zealand

This year there are 123 Pacific Islanders studying in New Zealand on Government scholarships. Last year there were 104.

Sixty-two Islands' students are attending secondary schools, while nine are studying at universities and eight at teachers' training colleges. Nine girls are being trained in dental nursing. Twenty Islanders are serving apprenticeships, while five are receiving training in various professions including medicine and dentistry.

Growing Pineapples On Mangaia

Pineapples are a main source of income for the people living on Mangaia, southernmost island of the Cook Group. The bulk of the crop is now sent to the canning factory established in Rarotonga in 1961. A changeover from Ripley Queen to a new variety of pineapple which leaves less waste in processing, Smooth Cayenne, is now in progress.

By J. W. CANTER VISSCHER*

A developing fruit of the Ripley Queen variety which is now mainly grown on Mangaia. It should be ready for harvesting in from five to six weeks.

THE island of Mangaia, the most southern in the Cook Islands Group (population 1,871, 1961 census) is almost circular in outline, with a total area of approximately 13,000 acres. A coral limestone reef known as the Makatea encircles the whole island as a coral belt which is up to 300′ above sea level and about a mile wide. Except in a few places where the central volcanic hill joins it, the inner edge of the Makatea is a vertical cliff.

The average annual rainfall is 78″, with the lowest monthly falls in July, August and September. Moderately fertile soil lies on the Makatea, and deep fertile soils are found at the foot of its inner cliffs. The central volcanic hill, which is infertile, is deeply dissected by numerous small streams. It extends to within 50 to 800 yards of the Makatea.

Pineapples are grown on the well-drained soils on the lower reaches of the inner volcanic hill. The variety Ripley Queen, which when fully mature is bright yellow with a light yellow, crisp sweet flesh, has been grown for the New Zealand fresh fruit market. Plantations of around one-half to two acres are worked by the owners and their families.

Plants are usually staggered in double rows which are 18″ to 24″ apart, with access between the double rows of 6′ to 8′. This planting pattern provides sufficient access for inter-cropping with tomatoes, which is often practised in young plantations on soils near the inner cliffs of the Makatea. The average number of pineapple plants is, however, only 7,250 to the acre.

Under favourable conditions — adequate rain and warm temperatures—the crop commences to mature during the second or third week in October. The bulk of the crop matures during the last week in November and the first week in December, and normally ends during the first week in January.

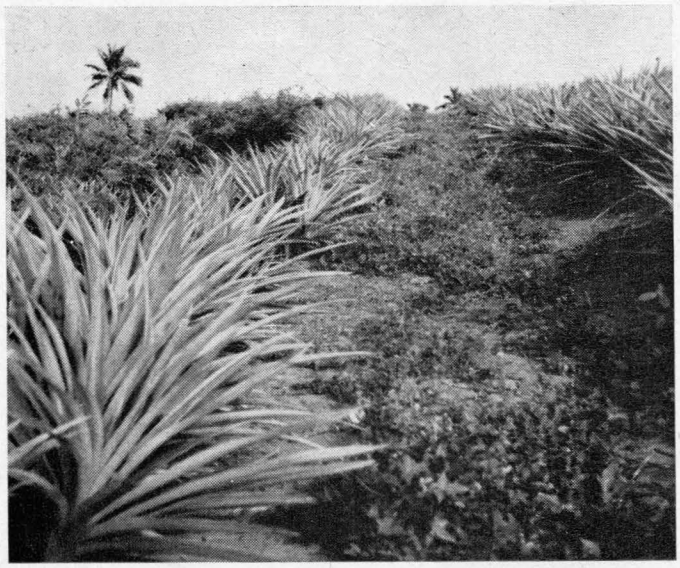
The fruit is picked and packed the day before a ship calls. It is cut with stalks of 1″ to 1½″, and the crowns are left intact. Under the supervision of fruit inspectors in packing sheds in the villages, the fruit is graded and packed in cases of 1½-bushel capacity each, holding 18 to 24 pineapples. Fruit measuring less than 4½″ from shoulder to base is rejected.

The export of pineapples from Mangaia to New Zealand began in 1949, and has since become an important source of income for the people of the island. There was a steady increase of pineapple exports from 1,337 cases in 1949 to 24,002 cases during the 1956-1957 season. Nett returns per 1½-bushel case fluctuated over the years between 7/11 and 14/7½d. N.Z.

Owing to a variety of circumstances, including a disagreement over prices during the 1956-1957 season, the growers

* Agricultural Officer, Cook Islands Administration.

Pineapple plantation on Mangaia. Note inter-cropping with tomatoes in background.



Centrosema pubescens being used as a cover crop to prevent erosion.

Right: Typical plantation of young pineapples on Mangaia.

lost interest in the crop, and exports fell to only 4,260 cases during the 1957-1958 season, and decreased to 1,310 cases during the 1960-1961 season. Aware of the disastrous effects that the extinction of the industry would have on the economy of the island, in 1960 the Cook Islands Administration appointed an Agricultural Officer to Mangaia whose main concern was to re-establish the industry.

A vigorous replanting scheme was introduced. Surveys were made of the existing plantations and fertilizers distributed to growers based on the number of plants each had. Growers were persuaded to extend their plantations and, to speed up the replanting scheme, a tractor with plough and discs from the Government machine pool was hired out on credit.

Control Of Erosion A Problem

As elsewhere where pineapples are grown commercially, the control of erosion in plantations is a major problem. In new plantations—particularly before the pineapple plants are large enough to form a canopy—the run-off of soil is very serious indeed. Contour planting, together with adequate drainage and terracing, were encouraged, and these, with the use of cover crops such as *Centrosema pubescens,* proved successful in minimizing erosion.

The canning factory which was established in Rarotonga in 1961 has given the pineapple industry in Mangaia a tremendous impetus. Losses of fruit through lack of shipping were nil during the 1961-1962 season, when 10,227 cases were shipped to the factory by local vessels and 1,394 cases exported to New Zealand by the MOANA ROA. The growers received 1¾d. nett per pound, or 6/7d. for a 45-pound case, shipped to the factory. (Fruit for the factory is cut without stalks, and the crowns are removed.) Total nett return to the growers during this season was £4,523.

Since the variety Smooth Cayenne leaves less waste in processing than Ripley Queen, a changeover was recently approved by the Legislative Assembly of the Cook Islands, and recently 27,000 Smooth Cayenne fruit were imported for propagation. The tops have been planted in polyethylene at 17,500 plants to an acre, and it is expected that, by 1966, distribution of the new variety will commence, with a complete changeover by 1967. On present-day prices the earnings from pineapple growing should then rise to at least £15,000 annually.

SPC Research Council To Meet In Tahiti

The expert advisory body of the South Pacific Commission, the Research Council, will meet from April 29-May 2. It will concentrate on health matters.

For the first time in twelve years the meeting will be held away from Commission headquarters. It will be convened at Papeete, and will follow the SPC Rural Health Conference being held there from April 18-27. Most of the Research Council members will be present at this meeting also.

It is expected that members attending the forthcoming Research Council meeting will include Mr. W. D. Forsyth, Secretary-General of the South Pacific Commission, who is also Deputy Chairman of the Research Council; SPC executive officers Drs. G. Loison (health), Richard Seddon (social development), and Jacques Barrau (economic development), all of whom are permanent members of the Council; Dr. R. F. R. Scragg, Director of Public Health, Papua and New Guinea; Dr. E. Massal, Directeur, Institut de Recherches Médicales de la Polynésie Française, Tahiti; Dr. C. H. Gurd, Director of Medical Services and Inspector-General, South Pacific Health Service, Fiji; Dr. A. S. Osborne, Chief International Organization Relations Branch, Division of International Health, Department of Health, Education and Welfare, Washington, U.S.A.; and Dr. G. O. L. Dempster from the Department of Health, Wellington, representing Dr. H. B. Turbott, Director-General of Health, New Zealand. Dr. J. C. Thieme of Western Samoa will also be attending.

Boatbuilding Instructor Visits SPC Headquarters

Mr. C. R. Fisher, well known throughout the area as the Director-Instructor of the FAO-SPC Regional Boatbuilding Course at Auki from 1960-1962, was in Nouméa from February 12-23 for discussions with Commission staff. Mr. Fisher then went on to Honiara to prepare for the opening of the next course at Auki during the week commencing March 11.

While in Nouméa Mr. Fisher visited Nouville and inspected preparations being made there for a second regional boatbuilding course for French-speaking trainees. This course is likely to open during the second or third week of April.

At the Auki course there will be thirty-two trainees representing seven territories within the Commission area. Five trainees from ECAFE countries will also attend.

Agronomic Research On Coconuts In The Solomons

Weighing green copra from plots on a fertilizer experiment.

This account of agronomic research on coconuts in the Solomons, begun in 1952 by Pacific Plantations Pty. Ltd., and carried on since 1958 jointly by that Company and the Government, was contributed by . . .

F. M. SPENCER*

IN 1952, Messrs. Lever's Pacific Plantations Pty. Ltd. appointed Mr. A. H. Green to conduct research into coconuts on their plantations in the British Solomon Islands Protectorate. In 1958, when it became known that Mr. Green would not be replaced when he left the Solomons, the Protectorate Government and Lever's Pacific Plantations Pty. Ltd. agreed to operate a joint agronomy scheme to continue research on coconuts, and in 1960 the Government appointed Mr. M. A. Foale, an Agricultural Officer in its service, to the post of coconut agronomist.

Under the terms of the agreement between the Company and the Government, Messrs. Lever's provide land, labour, housing, transport, fertilizers, and other facilities, while the Government has built and equipped a laboratory and pays for the agronomist and his staff. The Government contribution is financed from Colonial Development and Welfare funds.

The experiments, which have been laid down in the Russell Islands, can be divided into four groups, as follows:

(a) Fertiliser experiments on old palms.
(b) Replanting experiments.
(c) Maintenance trials on young palms.
(d) Miscellaneous trials.

Fertiliser Experiments On Old Palms

Between 1952 and 1954, six fertilizer trials were laid down in different areas and on different soil types. One was abandoned in 1959, but the remainder are being continued. They are all NPK factorial experiments, and are designated by the name of the individual estate on which they are laid out. In all cases the palms involved were thirty or more years old.

On two experiments at Lingatu Estate, significant increases in yield were achieved from N and P in one case, and from NK in both cases. However, in no case was the response large enough to offset the cost of the fertilizer. On a third trial at Faielau sited on a coral sand derived from a recently-raised reef with a calcium carbonate content of up to 98%, none of the fertilizer responses has achieved either statistical significance or economic importance. The largest response was to N, which gave an increase of 1.54 cwt. per acre. However, the results of button nut analysis from palms in this experiment indicated that they were particularly low in magnesium. In 1959 and 1960 magnesium sulphate at the rate of 850 grammes per palm was applied, and at the end of the second year increases in yield and in mean kernel weight occurred due to this treatment. There is every reason to expect that this response will continue to build up, and it is proposed to continue the applications and record the yields for several more years.

A fourth experiment at Faiami is sited on what, pre-War, used to be one of the highest-yielding estates in the Russell Islands with production exceeding 25 cwt. of copra per acre for several years. During the period covered by the experiment, the mean yield has been 14.6 cwt. copra per acre, and there has been a significant response to nitrogen.

At Somata a fifth trial is sited on very heavy soils, and has shown no indication of response to anything except potash. The high rate of potash (2 kilogrammes per palm annually) has significantly increased kernel weights only, while the low rate (half the high rate) has increased nut numbers and yield of copra. The reason for this is not apparent.

A sixth experiment was laid down on heavy soil at Pepesala, an estate which, during the War, had become heavily over-stocked with half-wild and unmanageable cattle. In addition to a complete fertilizer treatment (NPK), three other treatments—ploughing, deep cultivation and fencing to exclude cattle—were added to the original design. These extra treatments were included to combat the damage that the cattle were suspected of doing by trampling, and over-consolidating the heavy soil round the roots of the palms. Owing to lack of suitable equipment the ploughing treatment had to be abandoned, and it was replaced by an application of 2 kilogrammes of muriate of potash per palm per year. After three years the treatment which excluded cattle from the plots had significantly

* Director of Agriculture, British Solomon Islands Protectorate.

A tiller in use on the cultivation experiment at Banika.

Recording palm yields on the Pepesala replanting experiment.

increased copra production, but the treatment itself had in effect changed from what was originally intended. As soon as cattle were excluded, *Mimosa pudica* invaded the plots and soon dominated them. The comparison became virtually grass cover versus leguminous cover, the ungrazed and fertilized plots giving an increase of 6.6 cwt. of copra per acre over the grazed and unfertilized plots.

However, after five years, this effect had worn off and this treatment was no longer showing an improvement over the control plots.

The deep cultivation treatment initially reduced the yield of copra due to the severe root pruning caused by this operation, and even after five years still gave no response.

The complete (NPK) treatment significantly increased the yield over the years, but, even so, this increase in yield did not pay for the cost of the fertilizer, and applications ceased in 1958. However, the residual effects continue to be measured, and in 1959 and 1960 gave increases of 127% and 95% respectively over the controls, which is most encouraging. The application of potash alone had by 1960 also significantly increased yields, but only by about half as much as the complete NPK treatment, which indicates that either or both of the N and P fertilizers contributed to that response.

Replanting Experiments

These are a most important series of experiments, and are designed to show the different effects of treatments applied to new palms interplanted among old palms. Many estates in the Protectorate, and no doubt in other parts of the Pacific as well, are probably reaching the stage where they are too old to give economic yields, and the problem of replanting such areas must be considered as urgent. It is hoped that instead of completely felling the old palms, interplanting with young palms and continued cropping of the old palms for several years will offset the loss of income due to complete felling without any deleterious effect on the young interplants.

There are, at the moment, three of these trials planted in the Russell Islands, the treatments applied to each varying slightly. The first was laid down in 1954 on the Pepesala Estate, interplanted with old palms which were spaced at 30′ apart (triangular) and was designed to investigate the effects of fertilizers on young palms, different sizes of planting holes, and varying times of old palm destruction.

The fertilizers used were N, P and K, alone and in combination, and their rates of application increased with the age of the palms. Effects were measured by vegetative responses to treatments (frond weight, length and number), and there were significant increases due to N and K alone and in combination, but not to P.

Two sizes of planting hole were compared, one 3′ x 3′ x 3′ and the other 1′ x 1′ x 1′, both with and without fertilizer. Two and a half years after planting it was obvious from the vegetative measurements that a small planting hole in the presence of fertilizer was better than a large one in its absence, but large holes were better than small where fertilizer was used. After five years the advantage of a large hole with fertilizer had diminished and become negligible, while the ill-effects of them in the absence of fertilizer had become very evident.

Poisoning of the old palms commenced when the young palms were 2½ years old, and consisted of three sub-block treatments as follows:

(a) All the old palms retained.
(b) 50% of the old palms felled by poisoning.
(c) All the old palms felled.

In the second year after felling, palms without competition — treatment (c) above—produced more fronds than those with full competition from the old stand, and in the fourth year after felling, palms without competition produced heavier fronds than both other groups. The remaining old palms were poisoned early in 1962. The first palms started flowering at 5½ years old, and at 7½ years 78% of the palms had produced flowers. Records of nut production have been kept since 1961, and it will be interesting to see if those palms which significantly increased their weight and number of fronds under conditions of no competition continue to reflect this increase in terms of copra yield, or whether after a number of years of production the other two groups have caught up with them. Such results will have an important effect on timing the removal of old palms which are interplanted with coconut seedlings.

The second trial of this type was laid down on the Banika Estate in 1957 after studying the first three years' effects of the Pepesala replanting trial, in a stand

Mature palms poisoned on the Banika replanting experiment.

A drenching gun for injecting arboricides into palm trunks.

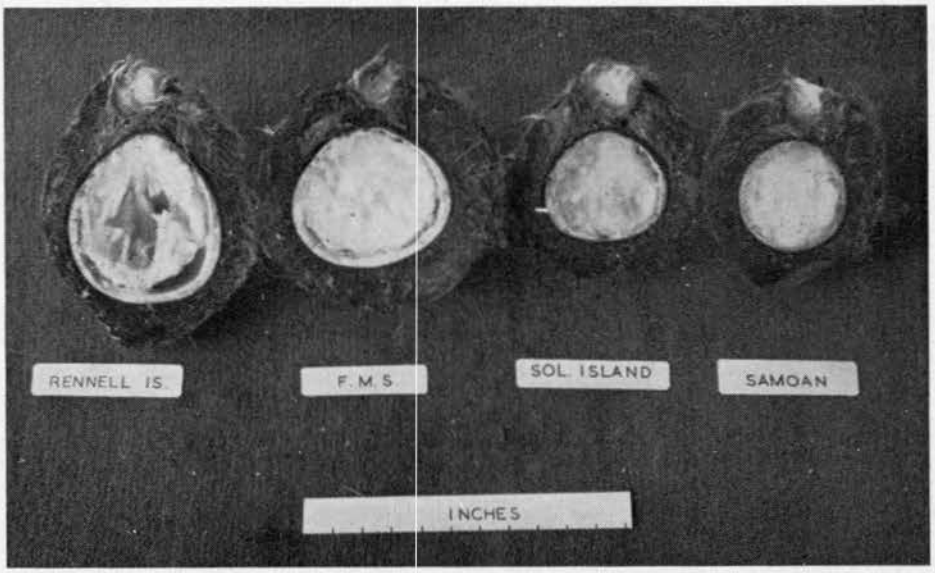
of palms 50 years old planted at 30′ triangular spacing. Four rates of potash were applied (both muriate and sulphate) and four rates of nitrogen (both urea and sulphate of ammonia). Two spare fertilizer treatments at two rates were provided for, according to the results of future leaf analyses. Finally, two cultivation treatments were included, consisting of disc harrowing six times a year compared with six rounds of normal hand brushing per year. In this experiment the old palms were killed off by poisoning by arsenical injection at the beginning of the experiment.

For the first six months, there was not a very great response to the clean cultivation treatment, but between October 1957 and April 1958, the height of those palms on the cultivated plots was 76% greater than those of the hand-brushed plots. It is too early to say whether this increase will persist, and, furthermore, the dangers of soil erosion, destruction of soil structure, and loss of organic matter must constantly be borne in mind under conditions of clean cultivation. Another interesting fact which has emerged from these two treatments is that the number of palms which had to be replaced due to swamp hen damage was significantly greater on the uncultivated plots (72%) compared with the cultivated plots (48%). It would appear, therefore, that the regular disc harrowing has had a very beneficial effect on the development of the young palms.

Urea was used in comparison with sulphate of ammonia because of its cheaper cost per unit of nitrogen, though sulphate of ammonia might give better results due to the beneficial effects of the sulphur present. Sulphate of potash has been compared with muriate of potash for the same reason, though it is more expensive than muriate. If sulphate of ammonia and sulphate of potash prove more effective than urea and muriate of potash respectively, it may be that the sulphur is largely responsible. If, on the other hand, urea is as good as sulphate of ammonia, but sulphate of potash is better than muriate, it may be that the chlorine in the muriate is having an adverse effect on the palms. By April 1961, responses measured vegetatively showed that the high rates of muriate of potash and sulphate of ammonia were having a greater effect than the other fertilizers. By October 1961 (4½ years since planting at the stake), 57 palms had began to flower and 51 of these were on the cultivated sub-plots. At the end of April 1962, 1385 spadices had been produced on the cultivated plots, compared with 596 on the uncultivated ones. At the same time, there were considerably more flowering palms on the plots receiving the highest rates of muriate of potash, and on the plots receiving sulphate of ammonia.

A third replanting experiment was planted in 1961-1962 on the Banika Estate among 54-year-old palms planted at 27′ triangular. This trial incorporates a considerable number of treatments including: varying times of old palm removal, small planting holes versus planting in a cultivated strip, root pruning of old palms at the time of replanting, no fertilizer in the planting hole versus com-

The ripper used for root pruning old palms.



The four types of nuts used in the variety, spacing, fertilizer trial at Loavie.

plete fertilizer, and large seed nuts versus small seed nuts from Federated Malay State hybrid nuts.

A further treatment has been provided for at later date, consisting of no fertilizer versus a fertilizer mixture applied according to the results of foliar analysis of the young palms.

Maintenance Trial On Young Palms

The weeding of newly-planted palms involves a considerable amount of expense and effort, and two experiments in the Russell Islands have been designed to try and reduce this. The treatments in one of these trials consists of comparing the usual maintenance method—that is, hand brushing of rings and paths—with a mulch of old copra sacks, and an arsenical spray. After six months the mulch treatment gave a 22% increase in vegetative growth over the conventional method of maintenance. This trial is being continued.

The second trial was laid down early in 1962, and compares hand brushing with five different herbicides alone and in combination, applied at five different rates at three different intervals of four, eight and twelve weeks. Results to date have varied, some of the herbicides being more efficient than others, but so far only arsenic can compete on a cost basis with hand brushing.

Miscellaneous Trials

The largest and most complicated of these is a variety x spacing x fertiliser trial laid down on virgin land on the Loavie Estate in 1961. The existing plantations in the Russell Islands are for the most part planted at either 27′ or 30′ triangular spacing, giving 69 and 56 palms per acre respectively. Although there have been no experimental comparisons between the two densities, records show that both have yielded crops varying from 20 to 25 cwts. of copra per acre per annum.

In order to statistically test population levels, three spacing treatments—27′, 24′ and 21.6′, all triangular—have been incorporated. These spacings will give populations of 69, 87 and 108 palms per acre respectively. It is possible that the latter population is too great but the possible advantages of close spacing should be considered. Such advantages may be: reduced weeding costs, more congenial working conditions for labour, leading to better output, and greater opportunities for the selective removal of non-productive palms.

Four strains of seed nuts have been used in this trial, namely: Federated Malay States nuts, reputedly the most susceptible to attack by *Brontispa*; local nuts, reputedly the most resistant to *Brontispa*; the so-called Bellona seed nuts from Rennell Island, which produce very large nuts; and nuts of Samoan origin, which produce large numbers of small nuts. No comparative data exists at present regarding the relative productivity of these different types of nuts, and there is certainly a need for information about their merits.

Finally, there are three fertilizer treatments—nil, complete, and fertilizer applied according to the results of foliar analysis. This last fertilizer treatment has been incorporated in order to test the reliability of diagnostic procedure.

In order to find cheaper methods of keeping coconut nurseries free of weeds, herbicide nursery trials were laid down in 1961. To date one weedicide has given effective weed control for three months when applied to bare soil after seedlings have sprouted. The cost of this chemical and its application has been less than half the labour costs of hand weeding a similar nursery, nor did the weedicide have any ill-effects on the palms.

A fertilizer trial has been laid down on a block of Fiji x Malayan hybrid dwarf palms obtained from Suva in 1955. Treatments applied were nitrogen, phosphate, and potash, and although the design does not lend itself to statistical analysis, indications are that throughout the whole period the palms have benefited from all three fertilizers. By December 1961, when the palms were nearly six years old, over half of them were producing some nuts.

Various arborcides non-toxic to man have been tested in an attempt to replace arsenic compounds used in poisoning old palms. However, no arboricide yet used has proved as cheap as the arsenicals.

Twenty-one-month-old palms in the trial at Loavie.

Left, unsprayed nursery bed. Right, sprayed three months previously.

Trace element trials comparing the sulphates and the chelates of copper, iron, manganese and zinc were laid down in 1962 on a coral-derived clay soil and a sandy coral soil. Palms 6½ years old and palms 1½ years old were used, and in each case foliar analyses were made before the application of the elements.

To date, the experimental programme has not included any plant-breeding work, but with the assistance of the South Pacific Commission, small blocks of seed nuts from Fiji (Rotuman and Fiji Hybrid dwarf) and New Guinea (Markham Valley) were planted in 1961, while in 1962 three distinct types of nuts from the Gilbert and Ellice Islands were obtained. These types, plus the different strains available in the spacing, variety, fertilizer trial, will make a useful genetical stockpile for any breeding work which may be carried out. At the same time a test sample of pollen from the Ivory Coast of Africa has been received with the assistance of the *Institut de Recherches des Huiles et Oleagineux*. It proved to be viable on arrival, and controlled crosses using this and other pollen will be made in the near future.

Summary And Conclusions

A coconut experimental programme has been in operation since 1952 on various estates in the Russell Islands belonging to Messrs. Lever's Pacific Plantations Pty. Ltd. Nitrogen, phosphate, potash and certain trace elements have been tried at varying rates of application on both young palms and old palms. On palms over thirty years old, potash has increased yields in the majority of cases, nitrogen occasionally, and phosphates seldom. In no case have the responses been great enough to pay for the cost of the fertilizer and its application. In one case the application of magnesium gave encouraging results.

Some of these fertilizer applications to old palms are being continued, while the residual effect of them is being studied in other experiments. It is too early to say how long the residual effect of fertilizer will persist, but there are indications that it may be for several years, albeit on a decreasing scale. Such persistence may increase the economic value of the fertilizer application.

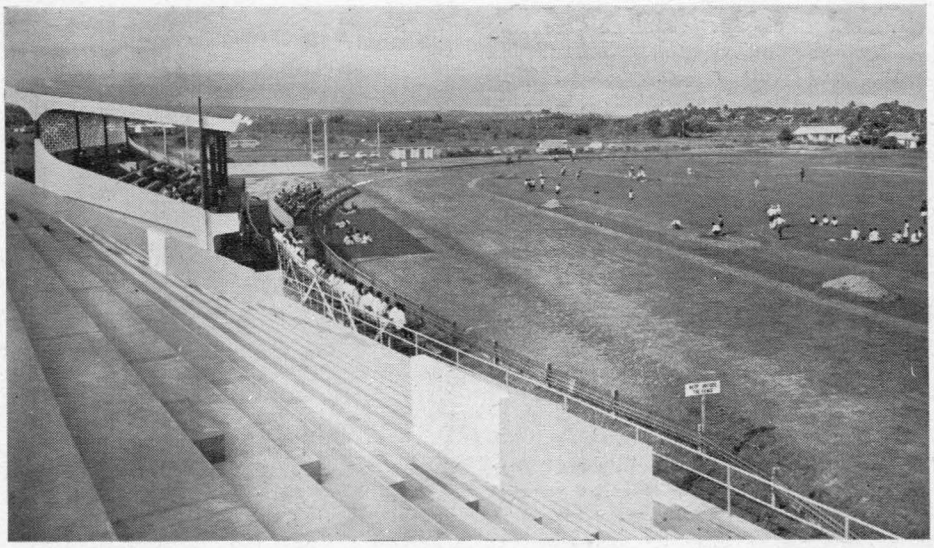
There have been encouraging results from the applications of fertilizers to palms in the age range 6 months to 7 years, where significant responses measured by vegetative increases have been achieved, mainly by nitrogen and potash, alone and in combination. It remains to be seen whether or not these increases will be reflected in greater copra yields in later years.

Three replanting experiments have been laid down with young palms interplanted amongst palms which are past their economic bearing age, the main treatments consisting of removing the old palms by poisoning at different ages in the early life of the young palms. It would appear that it may be possible to retain the old palms until the young ones have started to flower, though at present indications are that this will cause a reduction in yield in the early life of the young palms. This will have an important economic effect on the rejuvenation of old plantings.

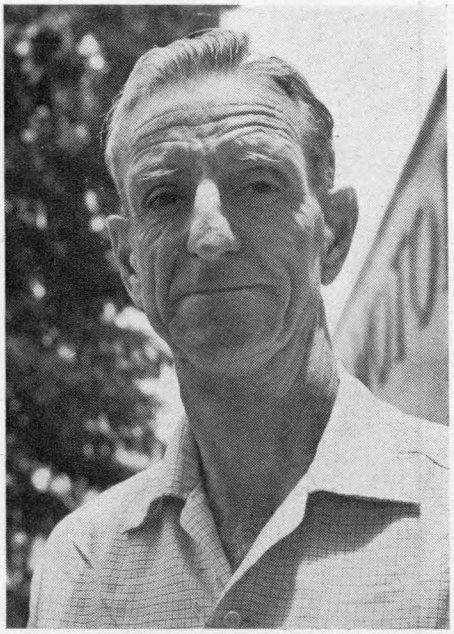
Several other treatments have been incorporated in these replanting experiments, and it has been found that small planting holes 1′ x 1′ x 1′ and clean cultivation have given significant increases in vegetative growth compared with large planting holes (3′ x 3′ x 3′) and hand brushing. Provision has been made to include fertilizer treatments according to the results of foliar analysis in the hope that an efficient technique can be designed to diagnose the nutrient requirements of coconut palms by this method.

(Continued on page 38)

Herbicide maintenance trial, showing an effective treatment.



Preparations at Buckhurst Park, venue for the Games, are proceeding according to plan. The new main pavilion, flanked by others, can be seen above. Beyond it is the basketball court, where the boxing events will also be held. Sprint events will be held on the new track in front of the pavilion, and longer races around the perimeter. Field events will be held in the centre.



Mr. W. P. Ragg, an indefatigable worker for sport in Fiji, is on the Games Committee. He was manager of the Fijian team which competed at the Commonwealth Games held recently in Perth.

600 Athletes To Compete At South Pacific Games

Nearly seven hundred athletes and officials from fourteen South Pacific territories will converge on Fiji in August for the holding, in Suva, of the first South Pacific Games. Excellent progress is being made with the extensive preparations for staging the Games, and for accommodating the teams and the thousands of visitors who are expected to attend.

By F. J. COYNE*

THE formidable task of preparing for the first South Pacific Games, to be held in Suva from August 29 to September 7 next, is proceeding to plan.

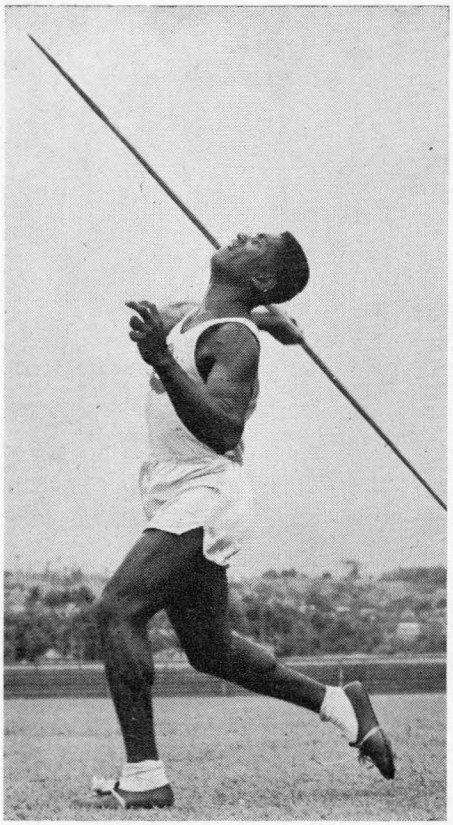
The following South Pacific territories have announced their intention to participate—American Samoa, British Solomon Islands, Cook Islands, Fiji, French Polynesia, Gilbert and Ellice Islands, Nauru, New Hebrides, New Caledonia, Niue, Papua and New Guinea, Tonga, Wallis and Futuna Islands, and Western Samoa. Guam and the United States Trust Territory of the Pacific Islands cannot now take part, due to the effects of the recent hurricane which swept those territories, causing severe and widespread damage.

Athletics (men and women), swimming (men and women), lawn tennis (men and women), indoor basketball

Maca Vakalala of Vatukoula winning a 220-yards event in Suva recently. She is a fine sprinter with speed close to the tape.

Start of a senior 100-yards sprint event at Suva. Sitivene Meceidreke, the winner, is nearest camera.

* Mr. Coyne, who was one of the English headquarters officials at the recent Empire and Commonwealth Games in Perth, has been appointed Director of Organisation of the South Pacific Games. He recently arrived in Suva to commence his duties. Mr. Coyne's experience in international sport as an official over the last thirty-odd years has included four Olympic Games and five Empire and Commonwealth Games.



The Rev. Viliame Liga throwing the javelin. He represented Fiji at the Perth Games.

(men and women), table tennis for men, boxing, Association football, Rugby football and volleyball are the sports on the programme.

Preliminary figures show that there will be nearly three hundred entries for the athletics, some sixty-six basketball players representing nine teams, and over forty contenders for the boxing titles. Seven territories will vie with one another for the soccer and five for the Rugby honours.

Over seventy swimmers will take part, and a similar number of entries is expected for the lawn tennis, which will be competed for on a team basis. Table tennis has attracted twelve entries, and volleyball, twenty-five. In all, nearly seven hundred competitors and officials are likely to be participating.

The preparatory work at Buckhurst Park, where the athletics, football, basketball and volleyball will take place, has almost been completed. The new stand, with seating accommodation for over seven hundred and with dressing rooms below, is finished, and the levelling, re-laying and drainage of the track has been successful. The surveying of this is now in hand.

Permission has been granted for a number of the features used to embellish Suva for the recent Royal visit to be re-erected at Buckhurst Park, and these, apart from their decorative appearance, will give cover from sun or rain in case of need.

Through the generosity of the education authorities, the Teachers' Training College and the Grammar School will house most of the competitors. The women competitors will have separate accommodation in the Girls' Wing of the Grammar School Hostel, while the Suva Hotel has been reserved for visiting officials.

Immediately following the closing of the Games will be the Hibiscus Festival, a week of carnival. It is to be regretted that the Games competitors will be unable to remain for this in the village, because there will remain a bare three days for the schools to be evacuated and prepared for re-opening.

Twelve Committees Active

Under the chairmanship of Mr. Madams, an active fund-raising committee has been exploring every avenue of obtaining the finances necessary for the promotion of the Games. A lottery with a first prize of £F3,000 is under way. Books containing 10 or 50 tickets at 5/- each are obtainable from Mr. Woodman, who would be pleased to send some to any territory willing to assist in supporting the Games.

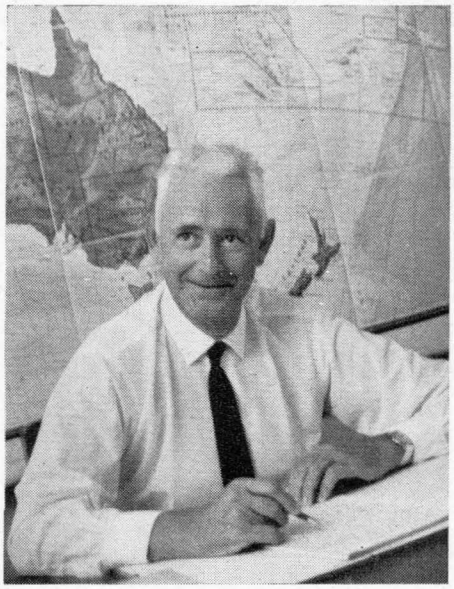
Eleven other committees are now engaged under the designations of press, communication and radio, village, grounds and stadium, accommodation, publicity, tickets, medical, ceremonial, transport, hospitality, and sports (the latter being representative of all the sports in competition).

Retiring SPC Secretary-General Vacates Post

Mr. T. R. Smith's five-year term of office as Secretary-General of the South Pacific Commission ended on March 21, when he left Nouméa for Sydney by air, accompanied by Mrs. Smith. After taking leave in Australia they will return to New Zealand, to live in Wellington.

Mr. Smith took up his appointment as SPC Secretary-General in March 1958. Previously he had held a number of senior appointments with the New Zealand Government, the last being a three-year term as Secretary to the Government of Western Samoa. Concurrently he was Head of the Public Service of that territory, a member of the Legislative Council, and, for a period, acting High Commissioner. In 1953 he was sent under the United Nations Technical Assistance Programme to Indonesia, as adviser on public administration to the Government of that country and as a member of the Indonesian National Planning Bureau.

In the course of his five years as SPC Secretary-General, Mr. Smith visited most of the territories in the Commission area. His term of office was noteworthy for the high degree of co-operation established between the Commission, territorial administrations, and agencies of the United Nations in the arranging and



Mr. T. R. Smith.

conducting of training courses and other projects designed to promote progress among the peoples of the South Pacific.

The first of a series of farewell functions in honour of Mr. and Mrs. Smith was a dinner held in the grounds of the Pentagon, SPC headquarters, on the night of February 16. This date enabled a maximum number of the Commission's staff, who are normally dispersed throughout the South Pacific, to attend. It was the first time that an outdoor function of this kind was held in the Pentagon grounds, the beautification of which will remain one of Mr. and Mrs. Smith's lasting contributions to the many attractions of Nouméa.

The incoming Secretary-General of the South Pacific Commission, Mr. W. D. Forsyth, arrived at Nouméa by the "Mariposa" on March 24 to take up his appointment, which is also for a five-year term.

Research On Coconuts In Solomons

(Continued from page 36)

A series of weedicide trials has been conducted on young palms, but, to date hand brushing has proved to be the cheapest operation. In coconut nurseries, however, one weedicide proved to be equally as efficient and much cheaper than hand cleaning.

A trace element trial was started in 1962, together with an experiment comparing four strains of coconuts at three population levels.

The cheapest arboricide for coconut palms has proved to be arsenic trioxide. A test consignment of coconut pollen imported from Africa proved to be viable.

ACKNOWLEDGEMENTS

I am indebted to Mr. A. H. Green, Mr. M. A. Foale, and the Managing Director of Lever's Pacific Plantations Pty. Ltd. for the experimental designs and results quoted in this article.

Typical coastline scene in Western Samoa where, on the larger islands, forested mountains sweep down to narrow coastal plains and the sea.

Western Samoa . . .

On January 1, 1962, Western Samoa achieved independent status. Today, fifteen months later, the new State is steadily developing its economy along modern lines, while at the same time preserving substantially unchanged the old Polynesian form of social organization.

By T. R. SMITH*

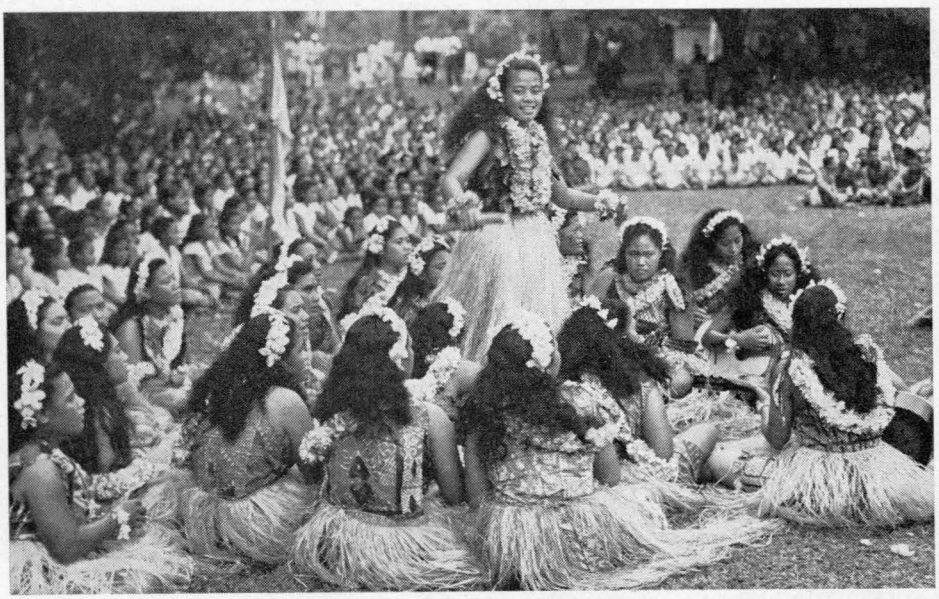
NO one knows where the Samoans came from nor for how long they have lived on the islands which are now their home. One tradition is that their ancestors came from "Pulotu." That word has never been identified as a place name, but it could well be a slightly changed form of *pulau tua*—in Malay, the "old island." But, wherever the old homeland might have been, carbon dating tests show that the Samoan islands have been inhabited for at least 1900 years. Within the group there are nine inhabited islands, from Savaii in the west to Ta'u in the east, all about 14 degrees south of the Equator and ranging from 169° to 173° west latitude.

The islands are of the high volcanic type with forested mountains which, on the largest island, Savaii, rise to 6,094 feet. Because the volcanic rock is very porous, much of the rain which falls on these mountains sinks into the ground and emerges only at sea-level. There are few rivers. It is for the most part therefore only on the comparatively narrow coastal flats and in the short valleys near the sea that the combination of sufficient fresh water, sea foods, and land suitable for growing coconuts, breadfruit and taro made human settlement attractive. The Samoans lived, and for the most part still live, in a series of village communities round the shores of their islands. Inland villages are rare.

The old Polynesian form of social organization has been preserved with less change in Samoa than in any other part of Polynesia. The basic social unit is the *aiga,* or extended family, headed by the *matai.* Land is owned by the family but is vested in the *matai,* whose responsibility it is to administer it in the interests of the *aiga,* every one of whom, provided he discharges his appropriate social obligations, is entitled to his share of the produce of the land and to living space on it. Land tenure is thus linked with social security.

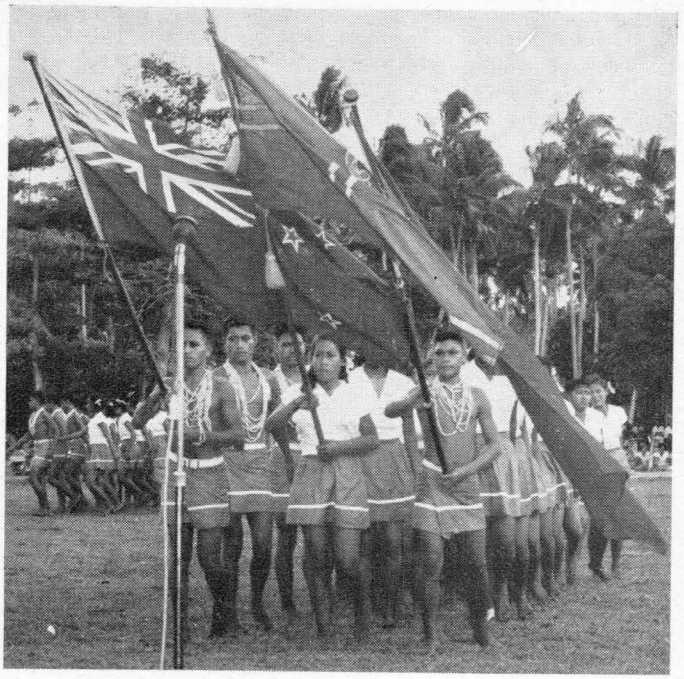
A village unit is usually a community of families, and village government is in the hands of the *fono* (council) of *matais.* Their jurisdiction was described by the late Hon. O. F. Nelson, a mixed blood Samoan leader of the last generation, as covering "the cleaning of villages, coconut and vegetable plantations, the maintenance of law and order in the villages, the upkeep and weeding of roads, the planting of mulberry for tapa cloth, making of fine mats, raising of pigs and poultry, control of fishing rights, maintenance of boundary walls and pig fences, the building of fishing canoes, boats and houses, etc." In old Samoa there was no other work for a governing body to do, and so no effective government above the village level. There was a hierarchy of *matai* titles, and the holders of higher titles enjoyed wide influence and very great ceremonial status though they had no particular executive authority. Two or more of the high titles could be held by the same

* The author, who last month completed a five-year term of office as Secretary-General of the South Pacific Commission, earlier had held the post of Secretary to the Government of Western Samoa for three years.



Graceful siva and other traditional dances are a feature of most Samoan gatherings.

Left: At the Independence Day celebrations on January 1, 1962, the Prime Ministers of New Zealand and Western Samoa lowered the flag of New Zealand and the old flag of Western Samoa, which until then had flown side by side. Immediately following this, the Heads of State hoisted the new Samoan flag.



All the school children took a great part in Independence Day celebrations. Here a village school performs a marching parade, with two youths bearing the flags of New Zealand and Western Samoa, while the girl in the centre is carrying her school banner.

person, and occasionally one person held the four highest titles which among them commanded the loyalty of all Samoans. Such a person could be regarded, for the time being, as King (or Queen) of Samoa, but there was no tradition of a continuing sole monarchy.

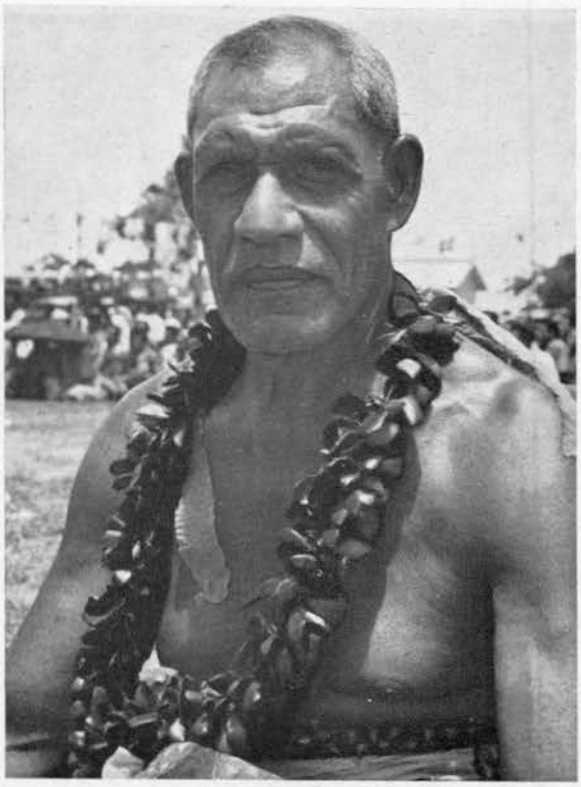
Though Samoans had contacts, warlike and otherwise, with Tongans and Fijians over the centuries, they first became aware of people from beyond the limits of their known world when the two ships of Commodore Jacob Roggeveen appeared in the eastern part of their islands in 1722. These people who came from somewhere beyond the horizon, where the sky curved down to meet the sea, were called by the Samoans *papalagi*, a term which is usually translated into English as "sky busters."

At intervals, there were visits by other *papalagi* ships, and by the early years of the nineteenth century occasional runaway sailors and other adventurers began to live in Samoa. From 1830 onwards Christian missions became established in Samoa, and before long all Samoans became Christians.

Other Europeans came as traders and settlers in increasing numbers, and the necessity for some authority to maintain law and order led to many unsuccessful attempts to establish a unified government. The latter two-thirds of the nineteenth century saw the normal Samoan conflicts and competition for power intensify and become more dangerous with the possession of European weapons. Different European national groups became involved and supported different Samoan leaders whom they wished to see established as King of Samoa. This

Left: Stalwart young Samoans carrying a roast pig for a feast.

This young lady is performing a tauaiuga. The typical traditional headdress (tuiga) she is wearing can only be worn on ceremonial occasions by a taupou or manaia, or by daughters and sons of certain high-ranking chiefs.



Above: Samoan craftsmen making a paopao, or canoe. This type is used for fishing inside the reef.

A typical member of a proud and independent race.

unsettled period ended in 1899, when control of all Samoa was assumed by the *papalagi* and divided between the United States and Germany. The United States took the eastern part comprising Tutuila, with its offshore islet of Aunu'u, and the group of three small islands known collectively as Manu'a. This area became known as American Samoa and, with that name, is still a United States territory.

The western part, made up of the large islands of Savaii and Upolu, with several smaller islets of which two, Manono and Apolima, are inhabited, passed to the control of Germany. Western Samoa thus became a separate political entity which was ruled by Germany until 1914, when it was surrendered to New Zealand armed forces. After the end of the First World War, New Zealand was made the administering authority under a League of Nations Mandate and continued as administering authority under a United Nations Trusteeship Agreement after the Second World War and until the end of 1961. From January 1, 1962, Western Samoa became an independent State.

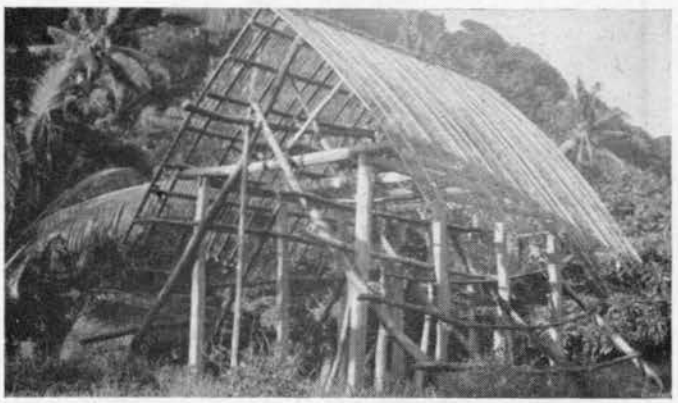
On that day the two high chiefs, Tupua Tamasese and Malietoa Tanumafili II, were sworn in as the joint Head of State of the new Independent State of Western Samoa. They hold office for life, and after both have died a single Head of State will be elected for a five-year term by the legislature—the Assembly.

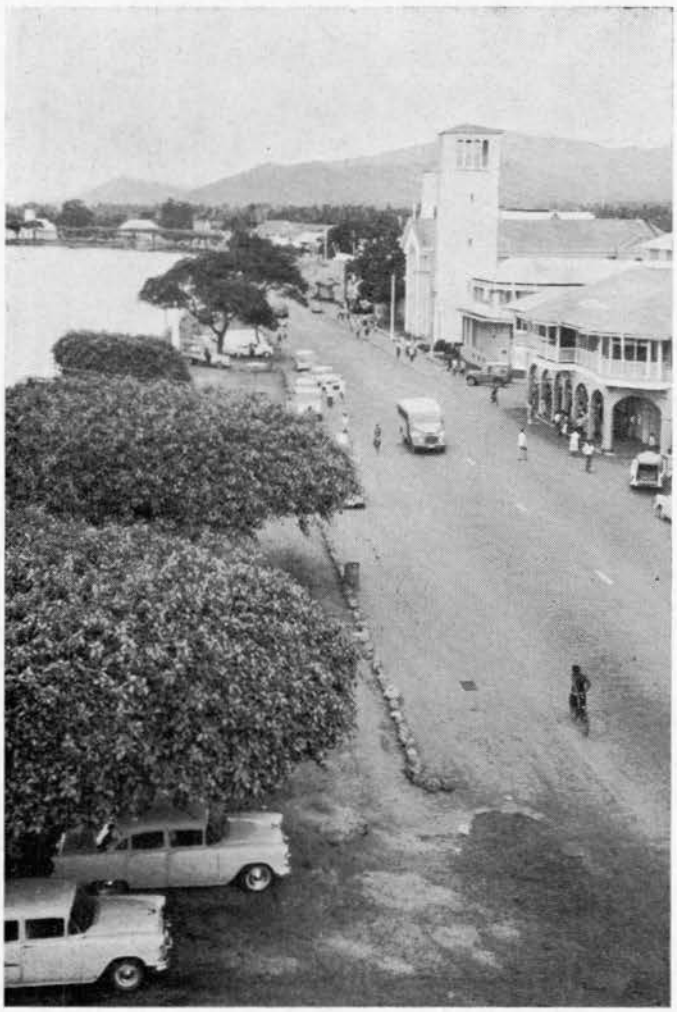
Speaking at the opening ceremony of the Assembly, shortly after he and Tupua Tamasese had been sworn in, Malietoa Tanumafili said: "By our constitution we have adopted with little modification the system of Parliamentary Government evolved among the English people". There have, though, been some specifically Samoan adaptations. There are 47 members, of whom 45 are elected by the *matai* as heads of their family groups. The other two are elected by voters on a common roll who are Samoan citizens and living as members of an *aiga* headed by a *matai*. The Prime Minister and members of the Cabinet are elected by the Assembly.

During the 40-year period from 1921 to 1961, the population of Western Samoa increased from 36,400 to over 114,000, of whom more than two-thirds live on Upolu, on which island is situated Apia, the capital.

The rapid population growth, which continues, poses a major problem for the Government of the new State. The small separate villages of former days tend to expand and merge along the coastal strip, and cultivations spread inland onto the thinner soils of the hill slopes. Roads and bridges for communications and the transport of crops, medical services, water supplies, schools for the ever-increasing numbers of children and all the other things which the modern state must provide for, call for a governmental machine far beyond anything known in

Below: Part of a typical coastal village on the outskirts of Apia. On the right is a guest house with elevated floor built up of stones. Right: A Samoan fale being built.





Left: Beach Road, the main street of Apia, runs along the waterfront.
Above: The Nelson Memorial Public Library is on the waterfront, facing Beach Road.

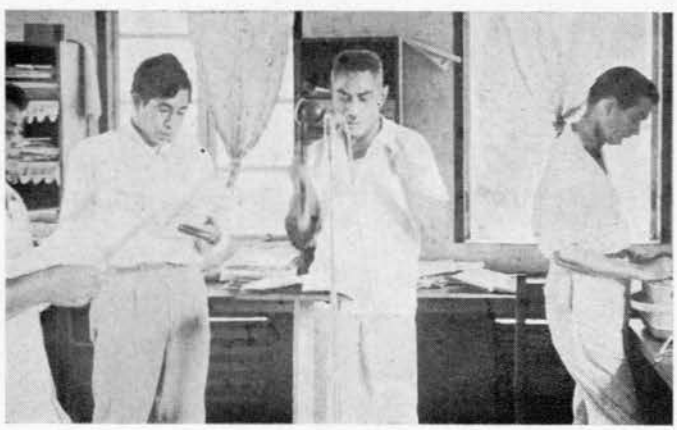
Below: This hospital was built solely by the efforts of the women's committee of Afega village, which is about six miles along the coast west of Apia.

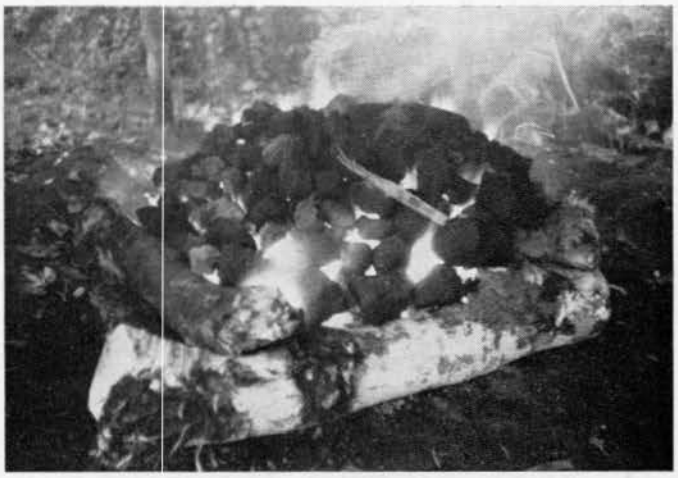
the Samoa of sixty years ago. A land tenure system which was suited admirably to the needs of subsistence agriculture in family and village units is strained to meet the needs of maximum production for exchange and export. How to increase agricultural production while maintaining the immense social advantages of family ownership and occupation of land under the control of the *matai* is one of the many pressing problems which Samoa now must solve.

Although Western Samoa receives some external financial assistance, mostly from New Zealand, the new State is basically self-supporting. Revenues depend heavily on the prosperity of the three main export crops of bananas, copra and cocoa. In terms of the Samoan pound, which is approximately equivalent in value to Sterling, the values of exports of those crops in 1959 were: Bananas £903,842, copra £1,400,000 and cocoa £969,860.

The Samoan Government has established an Economic Development Committee whose main task, "the establish-

Below: Lessons in both Samoan and English are broadcast regularly over 2AP Apia to all schools in Western Samoa and the Tokelau Islands.
Right: School children playing at mid-morning break.





Above: Green bananas and taro being prepared for cooking in a Samoan umu, or oven. Right: A Samoan umu. Banana stems or logs which do not burn readily are arranged on the ground in the form of a square to keep fuel and stones together. The fire is lighted, and when it is burning well the stones are arranged over the flaming wood. When the hottest stage of the fire has passed, the stones are spread out evenly, food is placed on top, covered by more hot stones, and afterwards by banana and breadfruit leaves, and finally over-all coverings of sacks or old mats.

ment of a sound economic plan for the future development of Western Samoa", must take account of the possibilities of expanding production of those and other crops, of exploiting fishing and forest resources, and of establishing secondary industries based on local resources.

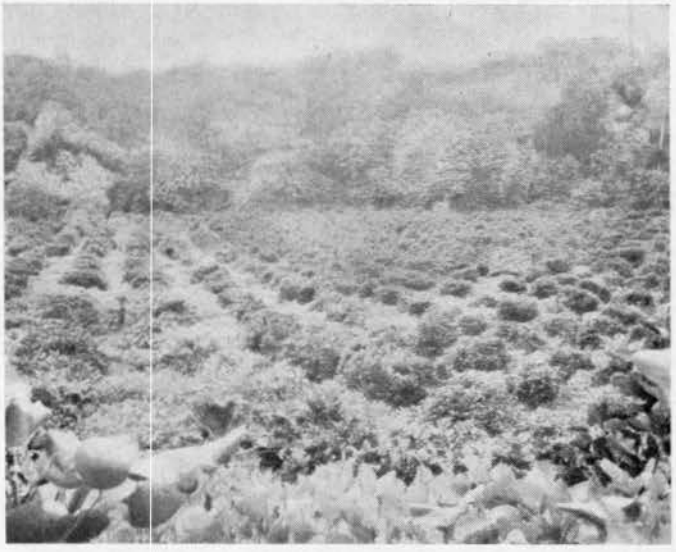
The old stable, but loosely organized, Samoan society of little more than a year ago has grown with great speed into a much bigger, closely-integrated modern State which is facing its future with admirable calmness and confidence.

A century ago Samoan leaders sat in their village councils, or represented their villages in distant assemblies, where problems arising from the impact of these new foreigners from beyond the horizon were debated. Decisions were made on the use of land or the allocation of fishing rights, but the aim was only to ensure that food production was adequate for family and village needs.

This umu-cooked meal is being served in Samoan style on the mat-covered floor of a fale, but on plates instead of the more customary banana leaves.

Today, the descendants of those leaders, bearing the same names, wearing clothes perhaps different as to material but not as to style, appear at the Council tables of the United Nations and with polite gravity argue the right of

Below: Cattle on Vailele plantation of the Western Samoa Trust Estates Corporation. Right: A Trust Estates coffee plantation.



their people to share in the freedom, the wealth, and the knowledge which is the common heritage of all mankind.

Production for use in the villages is still necessary, but so also is production of foodstuffs to export to the outer world in return for the produce of other countries which Samoans now need. Production for export requires other rules, other incentives and even adjustments to old customs, but the necessary adjustments are now discussed and decided on by the Assembly which meets, as did the ancient village *fono,* to resolve the problems of the day.

After a year of independence, the confidence of Samoans in their ability to manage all their own affairs seems amply justified.

On the Trust Estates plantations, re-planting of aging coconut palms is a continuous process. Copra is the main export from Western Samoa.

Left: A cocoa plantation. Cocoa is another principal export.

Below left: Carrying bunches of bananas in baskets of woven coconut palm fronds to a packing centre.

Below right: Packing bananas into cases in a village, for later collection by trucks for delivery to a wharf, where they will be inspected before being shipped overseas.

SPC Economist Visits Gilbert And Ellice Islands

Mr. V. D. Stace, SPC economist, left Commission headquarters in Nouméa on January 23 for Suva, en route to the Gilbert and Ellice Islands. There he has been carrying out, at the invitation of the High Commissioner for the Western Pacific, an informal survey of the agencies and facilities available for the encouragement of capital formation. He will make proposals for the best use of the entire financial resources of the Colony, to promote its economic development.

His survey will include a study of the wholesale and retail trading system, cooperatives, the copra industry, the freight system, savings and loan facilities, and the Colony development plan. He expects to be in the Colony about seven weeks. He will then return via Honiara, British Solomon Islands Protectorate in order to make his report to and have discussions with the High Commissioner and his officers about his findings.

The Editorial/Administrative Officer, Mr. E. P. W. Marriott, speaking at the graduation ceremony. Seated on his right are Sir David Trench, British High Commissioner for the Western Pacific, and Mr. A. M. Koenen, Technical Production Officer for the Centre.

SPC Literature Production Training Centre Closes

The SPC Literature Production Training Centre established in Honiara early in 1960 closed on January 3 last. At a graduation ceremony the British High Commissioner for the Western Pacific, Sir David Trench, presented certificates to the twelve trainees who had taken the last of the three one-year courses held at the Centre.

THE conclusion of the SPC Literature Production Training Centre at Honiara was reached with the graduation of its third one-year course, on Thursday, January 3, 1963. At the graduation ceremony, which was attended by many of the residents of Honiara and some distinguished visitors from overseas, twelve trainees received their certificates from His Excellency the High Commissioner for the Western Pacific, Sir David Trench.

In his speech of welcome, the Editorial/Administrative Officer of the Centre, Mr. E. P. W. Marriott, outlined the objectives and achievements of the Centre. Firstly, he said, there was the proving of the equipment and the suitability of the method of offset printing to meet the need of territories for cheap, small editions of a wide variety of printed material. There was no doubt left on that point, but experience and skill were still very necessary, and though Island lads could be trained in a year or so as valuable assistants, the printer himself had to be fully trained and qualified up to metropolitan standards.

Wide Area Served

Secondly, the Centre had trained thirty-six young men from a wide area of the Pacific stretching from Tahiti to Borneo and from the Marshall Islands to New Caledonia. Other territories that had sent trainees were Netherlands New Guinea, Papua and New Guinea, the British Solomon Islands, Fiji, the Gilbert and Ellice Islands, Western Samoa and the Cook Islands. As well as receiving their professional training, these young men from many different islands had the valuable experience of living together for a year and sharing each other's hopes, aspirations and experiences of life. During their time together, friendships had formed which bridged the ocean with human bonds.

Substantial Production

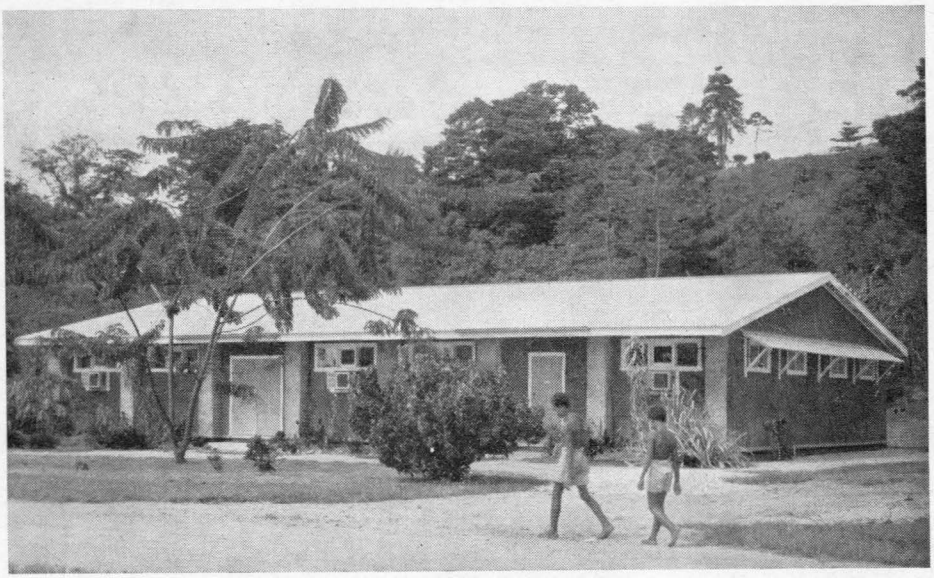
Thirdly, Mr. Marriott said, the Centre had made a substantial contribution to local literature. Much of the work had been the printing of government and commercial forms (the Job Book shows over 3,000 jobs—an average of about four completed jobs a day), but in addition to this very necessary practice in the mechanics of printing, the Centre had produced close on one hundred titles of literature proper. Of these books, some 86,000 copies had been sold. The Centre had worked in ten different languages and supplied not only the Solomons but Papua and New Guinea, the Gilbert and Ellice Islands, French Polynesia, and the New Hebrides. The most ambitious job had been the publication of the *Honiara Picture News*, a broadsheet profusely illustrated with half-tone photographs of recent events; perhaps the most popular job had been the BSIP Calendar, illustrated with pictures from the Solomons.

Before presenting the trainees with their certificates, Sir David Trench spoke of the outstanding success of the Centre, which had been made possible by the joint efforts of the South Pacific Commission, UNESCO, and the BSIP Government. It was, he said, very much a product of the attitudes and ideals of the Commission and typified the new spirit in the Pacific which that organization had worked so hard and successfully to foster. The idea was one of joint efforts and co-operative enterprises in the service of the people of the South Pacific over a wide field, sparked off by the Commission and directed by its devoted staff.

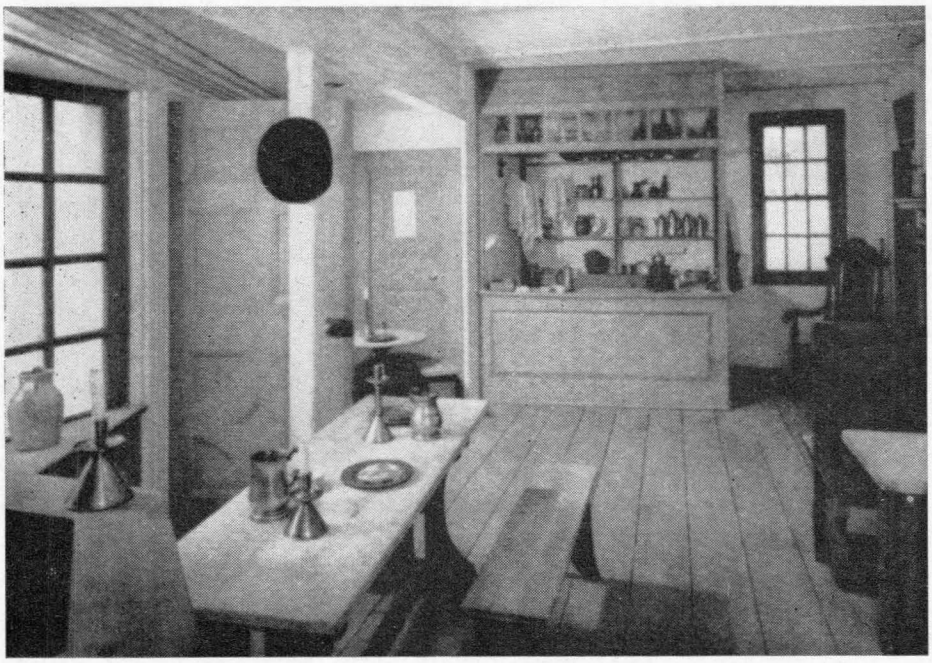
Training To Be Continued

Addressing the trainees from other territories, Sir David said he hoped they had enjoyed their stay in Honiara as much as the people of Honiara had enjoyed the diversity and fresh outlook

(Continued on page 65)



The air-conditoned building specially built in Honiara for the Centre by the British Solomon Islands Government.



Reconstructed interior of Edward Lloyd's seventeenth century coffee house in London. Here began the now internationally-famous "Lloyds of London" insurance market and world centre of marine and aviation intelligence.

The Story Of Coffee . . .

Coffee was first used only as a medicine, an Arabian physician of the ninth century being the first to record its properties for this purpose. The credit for first using it as a beverage is generally ascribed to the Prior of a Mohammedan monastery in Yemen, who towards the end of the fifteenth century discovered that an infusion made from the berries dissipated drowsiness. Thereafter he used it to keep his monks wakeful at their devotions. Today, world consumption of coffee beans exceeds four million metric tons annually.

By D. R. A. EDEN

DURING the past five hundred years coffee has grown steadily more popular as a beverage. Today, world consumption of the beans has reached a total of some 4,000,000 metric tons annually and there is every indication that the demand is increasing.

In the midlands of Africa, about twenty-five wild species have been discovered and classified by botanists, but relatively few have been cultivated for commercial purposes. *Coffea arabica* is the most extensively-planted variety, and makes up the bulk of world production. *C. liberica* and *C. canephora* (Robusta) are two other varieties which are cultivated on a large scale.

Liberian Coffee

The species *Coffea liberica* was originally found in West Africa. Specimens were collected in Sierra Leone by the botanist Afzelius as early as 1792, but it was not until 1874 that material from Liberia was studied by Bull, who classified and named the species after that country.

Although named *liberica,* its native distribution stretches from Guinea on the far west coast of Africa to the Nile Basin in the east. Its northern extreme lies in the region of Lake Chad, while its southern limit is somewhere below the middle Congo. Within this vast area the variety shows a discontinuous pattern of occurrence, and, as may be supposed, there is wide botanical variation within the species.

Coffea excelsa is a closely-allied species which is planted commercially. It is said to be more resistant to cold than *liberica,* and has smaller fruits. These resemble the Arabian variety, while its beans lack the tang and some of the bitterness of the more usual Liberian coffees. This hardy coffee became popular with planters when the Hemileia rust disease decimated plantations of the Arabian variety. Crosses have occasionally been established between *liberica* and *arabica,* and indeed some of these hybrids are grown on a fairly extensive scale. As an example there is Jackson's Hybrid, which is said to be Arabian crossed with Liberian and back-crossed to Arabian.

Robusta Coffee

Robusta coffee is botanically known as *Coffea canephora,* though H. F. Macmillan (1943) refers to it as *C. laurentii.* It was called Robusta because of its high resistance to the Hemileia rust disease and its tolerance to lack of husbandry. It possesses the ability to compete for existence against most of the weeds and grasses which are found on tropical plantations. The species became popular for cultivation around the turn of the present century, when it was found that it could be successfully grown on abandoned land originally planted under Arabian coffee trees which had died out because of rust.

According to Wellman[1] the region of origin of Robusta is widely spread, covering much more variation in ecology than that from which *C. arabica* originally came. Its indigenous region extends across the tropical central portion of the African continent, from west to east in its widest part. The plant grows wild even under more temperate conditions.

The Common Robusta bean is unattractively small, and many attempts have been made to hybridize the coffee in order to increase the size of the fruit. An outstanding clone known as S 274 has been developed in India. This is popular among planters because of its larger beans, which are reputed to have good cupping qualities.

Robusta coffee is used largely for blending purposes as the variety is said to give 'body' to a mixture. It has a high caffeine content and is said to be used in fairly large proportions in soluble high quality coffees of the 'instant' type.

Arabian Coffee

The Arabian species was the first coffee known to man. Until towards the close of the nineteenth century this "beverage of Arabia" was practically the only coffee marketed, since it was the only species which had been cultivated for commercial purposes. It was not until the Hemeleia disease threatened its extinction in many coffee-growing countries that alternative rust-resistant species were planted as substitutes.

First used as a medicine, the qualities of *C. arabica* have been known for nearly a thousand years, though its history as a beverage goes back for only half that time.

[1] *Coffee; Botany, Cultivation and Utilization,* by Frederick L. Wellman. New York: Interscience Publishers, Inc., 1961.

Above: Coffee nursery at Nadurulouloulou plant introduction station, Fiji.

Right: Liberian coffee tree. This species was first found in West Africa.

Arabian coffee is found in its native condition in valleys in the mountains of Ethiopia. Its fruit was harvested there from the wild trees long before the Ethiopians cultivated it as a plantation crop.

There are differences of opinion regarding the actual birthplace of the species. Arabia and Abyssinia (Ethiopia) have both been credited with being its land of origin, but the vast number of wild *arabica* trees, and their distribution over large areas of the Ethiopian jungles provide strong evidence in favour of the belief that it is indigenous to those forests.

On the other hand, there is no doubt that its establishment in Yemen in southern Arabia dates back to antiquity. Mohammedan tradition holds that coffee was miraculously revealed to the faithful in "a part of Araby the Blest which is called Yemen the Happy".

Whether the origin of the species *arabica* was Ethiopia or Yemen is mainly a matter of academic interest. Of more general interest are the legends and reports of its discovery, first as a medicine and, much later, of its adoption for use as a potation at Mohammedan religious ceremonies. From such beginnings coffee became a favourite beverage in all the Mohammedan countries of Europe, Asia and Africa, and then spread in use and popularity throughout the world.

To the Arabians is ascribed the credit for discovering the use of coffee as a medicine. We read that a famous Arabian physician known as El Razi or Rhazes (865-923 A.D.) wrote books[2] on medicine and surgery of his time. His principal book contained a list of all known drugs and their uses, quoting from Galen onwards. He was, according to Dufour (France, seventeenth century), the first writer to mention the properties of coffee, then known by the name of "bunchum".

In his writings, Forbes Robinson says that bunchum was something other than coffee. He points out that Dufour, in a later edition of his *Traitez Noveaux et Curieux du Café* was inclined to change his mind about bunchum. He admitted that this may not have been coffee as he first supposed, but a root. However, it is emphatically stated by Ukers that the early Arabians called the coffee tree and the coffee beans, bunn; the drink, bunchum. He goes on to say that Leonhard Ranwolf, a German physician, is believed to have been the first European writer to mention coffee.

Ranwolf first tasted the beverage in Aleppo in 1573. He told how the drink was prepared by the Turks, and follows this by a botanical description of the plant. He tells about the husk of the beans and the two inner shells. He says . . . "these two have within them two yellowish grains in two distinct cells; they agree in virtue, looks and name with the bunchum of the Arab physician El Razi exactly; therefore I take them to be the same".

The Sheikh Abd-alkader Ausani Djezeri, in a document of 1587, wrote that the first known use of coffee as a beverage dated back to 1470 A.D.[3]

Accepting the fact, therefore, that El Razi did describe coffee as a medicine around 900 A.D., there is a lapse of nearly 500 years before it came to be known as a beverage in 1470, as recorded by the Sheikh Djezeri. For the greater part of this period, then, we may assume that the plant was used by monks and physicians solely for its medicinal properties.

Legendary Accounts Of Discovery

According to a number of legends, it was the Mohammedan monks who were the first to become familiar with the properties of coffee. One of the most popular of these legends concerns its discovery. It runs as follows:

Once upon a time an Arab herdsman called Kaldi was in the habit of grazing his goats on a rich pasture which was bounded by wild coffee trees. This man complained to a nearby monastery that his herd frequently remained awake all night, leaping about in frisky gambols and excited dancing.

When the Prior heard this he became interested in the man's story and, upon going to the pasture, he was shown some shrubs laden with red and green berries upon which the goats had been feeding.

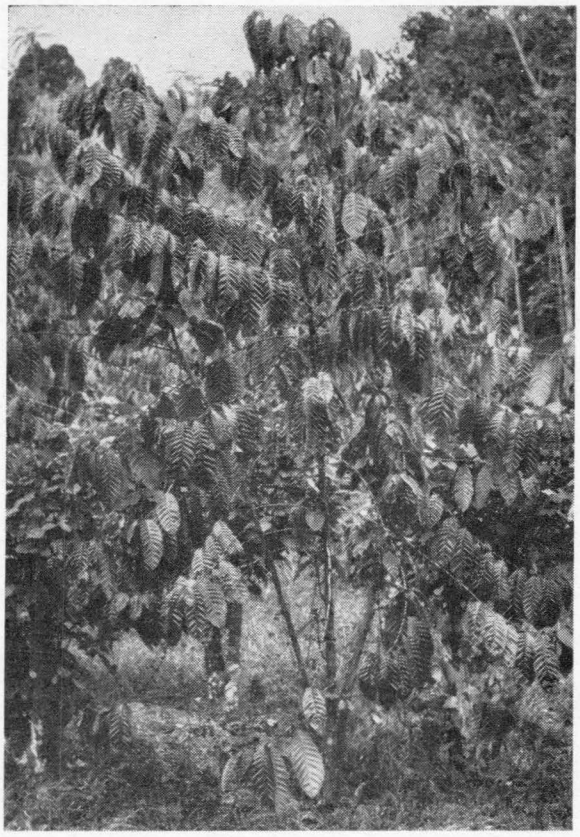
"These coloured nuts", said Kaldi, "cause the night-time wakefulness of my goats. When I eat them, I too join with my animals in their dancing, for I am then no longer sleepy".

The Prior decided to make an experiment and, picking a quantity of the berries, he returned to the monastery and boiled them in water. Later, when he drank the infusion, he found that it dissipated drowsiness, without having any bad after-effects.

Delighted with his discovery, he made immediate use of the drink to keep his monks wakeful at their devotions, and

[2] *All About Coffee*, by William H. Ukers, 2nd Edition. New York, 1935.

[3] *The Early History of Coffee Houses in England*, by Edward Forbes Robinson. London, 1893.



Above: Coffea arabica. The Arabian species was the first known to man.

Left: Robusta coffee tree (Coffea canephora). Robusta coffee is used mainly for blending purposes.

the use of the infusion soon became general at evening prayers.

Some truth may lie in this legend, because it is probable that coffee was first prepared as an infusion from the red berries. Caffeine and other principles would be extracted by the boiling, but the liquid would be unpalatable. It would certainly lack all the flavour and aroma of coffee made from ground dried and roasted beans. It is unlikely that the infusion would be suffered as anything but a medicine. This may account for the delay of hundreds of years between a knowledge of the properties of coffee and its use as a popular beverage.

Ceremonial Use As A Beverage

Coffee as we know it today—more or less—was first used by an order of Mohammedan monks. This order had come to Cairo from Yemen some time towards the end of the fifteenth century. During their devotions at the mosque, coffee would be brought in, steaming hot and ready to be served. This was emptied into a heavy glazed earthenware container on the right-hand side of the Prior. Into this font small bowls were dipped by the Superior, and these were solemnly offered to each monk in turn as they chanted their prayers.

Later it became the custom for the monks to share this ceremonial coffee with the laymen who came to prayers. Thus the drinking of the beverage eventually merged into the ritual of worship. Reports and legends alike agree in attributing the early uses of coffee to the Mohammedan priesthood.

There is evidence of its use and also of its prohibition in Mecca in 1511. The story goes that the Governor of Mecca become disturbed by reports of disaffection stemming from coffee drinking in the temples, and upon entering one of these he found a gathering of idlers drinking coffee in an ante-chamber. His soldiers ejected the idlers, and the Governor subsequently ordered the closing of all places where the beverage was drunk and the confiscation of stocks of coffee.

However, the drinking of coffee had by this time become so bound up with religious observances in Cairo that, when the Governor reported his action to his ruler there, he was astonished to receive a severe reprimand for his impetuosity. He was obliged to repeal the prohibition and to return all the confiscated stocks of coffee.

A similar incident is told by Forbes Robinson concerning London coffee houses during the reign of Charles II, who issued a proclamation in 1674 for the suppression of coffee houses on the grounds that they were a resort for idle and disaffected persons and "a place where tradesmen waste their time instead of working". This apparently raised so much bitter feeling that Charles, "having no wish to go on his travels again", was forced to withdraw the proclamation and to content himself with a few inconsequential restrictions over the houses, which were never enforced.

The coffee house originated as an institution of the East. The early Arabian, Syrian, Egyptian and Turkish establishments all had much in common. With high ceilings and spacious interiors, their tiled floors were often covered with valuable Oriental rugs. At night the rooms were brilliantly lit by myriads of lamps. Entertainments were arranged by the proprietors, who hired musicians, magicians, jugglers and acrobats, while poor scholars were sometimes given an opportunity to 'raise a purse' by reading stories about popular heroes or by telling their own tales to amuse the patrons.

The habit of drinking coffee spread throughout Europe during the sixteenth and seventeenth centuries, and it was within this period that the vogue of the coffee houses began to change the social customs of the West. The new beverage began to draw away the patronage of wits, writers and philosophers from their accustomed haunts at the taverns. At the new 'cafés' they could air their thoughts and argue their views over a steaming cup "without befuddling their wits with the effects of mulled ale".

In England, the popularity of the coffee houses in the seventeenth century had a direct bearing upon the rise and popularity of clubs. Meeting at their chosen coffee house, each club would acquire a settled address and special rooms were provided by the landlord for their activities. For this privilege club members were rarely charged; the landlord was usually content with his profit on the coffee and food consumed.

Early Coffee Houses

The *Encyclopaedia Britannica* gives 1652 as the date of establishment of the first coffee house in London, and quotes from a coffee advertisement of that year whose original is in the British Museum. The owner of the first coffee house, Pasqua Rosée, proclaimed that coffee "quickens the spirits and makes the heart lightsome . . . excellent to cure the

dropsy, gout or scurvy . . . neither laxative nor restringent".

Samuel Pepys was a member of a political club called the Rota, which he mentions in his diary as the Coffee Club of the Rota. It is thought that this was because it met in Miles's Coffee House in Westminster. The date of his patronage there was 1659.

Apparently this club was not without the usual number of political 'hotheads', and several arguments ended in unpleasantness. In order to ensure harmony thereafter, a small box was used, so that by secret poll any questions could be put to the vote. It is believed that this was the first ballot box ever used in England.

Situated in Lombard Street, Lloyd's Coffee House became famous. From a simple beginning it achieved great influence in the business world by becoming a meeting-place for the principal merchants and ship-owners of London. Lloyd's eventually came to specialize in marine insurance and, providing a ship was duly listed as "A1" on Lloyd's register, its member underwriters would accept a risk on such a vessel in almost any marine venture.

On the Continent—particularly in France, Holland and Germany—coffee houses flourished from the seventeenth century. In North America the first coffee shops were opened in New York, Boston and Philadelphia around 1680; actually the first licence to sell coffee was issued to a Dorothy Jones of Boston in 1670.

When the use of coffee became world wide during the seventeenth century, Yemen was practically the only country in a position to export the raw product. Mocha became the centre of trade in the commodity and the principal port of shipment. Its name still stands as a symbol of quality in Arabian coffee.

Prices for the raw product rose sharply as supplies became scarce, and this acted as an incentive for the establishment of the crop in other tropical lands.

Seeds Smuggled Into India

A law had been passed in Arabia forbidding the export of coffee beans which were not first devitalized to prevent germination. This measure was to prevent other countries from growing the crop and so protect Arabia's principal export against outside competition.

The measure was doomed to failure. Thousands of pilgrims journeyed from India to Mecca annually, and live coffee seeds could easily be obtained and slipped into the folds of a pilgrim's *dhoti.*

According to Indian tradition, a certain pilgrim named Baba Budan managed to smuggle out a quantity of viable *arabica* seeds in the year 1640. He planted these in the gardens of his home at Chickmaglon, which lay in a valley in the mountains of Mysore, and the trees flourished.

When the British commenced planting coffee in India in 1840, the natives of Kurg and Mysore had large areas already under cultivation. Millions of these coffee trees are said to have been established from Baba Budan's original importation.

First Plantings In Other Countries

Writing in *Tropical Planting and Gardening,* H. F. Macmillan states that coffee was first brought to Ceylon about 1690 (another authority says 1658), but that its cultivation on commercial lines was not begun until 1825. It is possible, since all the early plantings were Arabian coffee, that they were grown from seed brought over from India from the progeny of Baba Budan's original stock.

Java and the other islands of the Netherlands East Indies commenced planting coffee in 1696, while on the other side of the world, Haiti and San Domingo opened plantations in 1715; Surinam followed in 1718, while Brazil commenced growing coffee on a commercial scale in 1727. Jamaica began its coffee industry in 1730 and Cuba in 1748; Venezuela, Mexico and Colombia followed a few years later in the eighteenth century.

An Epic Journey

A remarkable story is told of how coffee was taken to the New World by a young French officer named Gabriel Mathieu de Clieu. Stationed at Martinique in the Leeward Islands of the West Indies, he endured many hardships and privations to take a coffee plant on a long ocean voyage from France to Martinique.

The story parallels another epic journey made by an African blacksmith named Tette Kivesi. Tette took cocoa seed from the island of San Thome to the mainland of Africa in a dugout canoe, over hundreds of miles of open ocean, and his gallant action led to the foundation of the vast cocoa industry of the Gold Coast.

Tette had decided that only cocoa could help his homeland, while de Clieu, acting under a similar compulsive urge, was convinced that only coffee plantations could help Martinique towards economic independence.

During a visit to Paris, he appealed to a 'lady of quality' for her assistance in obtaining permission for the release of a seedling coffee tree of the Arabian species from the *Jardin des Plantes* at Paris, for transplation to Martinique.

Because his object was patriotic, he at last obtained one seedling. With this as his most treasured possession, he then

Captain de Clieu sharing his meagre water ration with the coffee seedling he took across the Atlantic to Martinique in the eighteenth century. The vast coffee industry there today stemmed from this single tree.

commenced a great ordeal on shipboard as he crossed the Atlantic. Nurturing his tiny coffee plant through attacks by pirates and grave risk of foundering in a series of violent storms, his greatest trial came when the ship's supply of fresh water ran low. Everyone on board was allowed only a meagre daily ration, and de Clieu was forced to share his scanty supply with his precious seedling!

Arrived at last in Martinique, the seedling was planted. The young tree made healthy growth, and was actually guarded by soldiers and nursed by de Clieu until its first harvest of coffee beans. By 1777, when the dedicated de Clieu died, from this single mother tree had stemmed some 19,000,000 coffee trees in Martinique. From the seeds of these trees a large proportion of the coffee plants in the Americas are said to be descended.

PICTURE CREDITS

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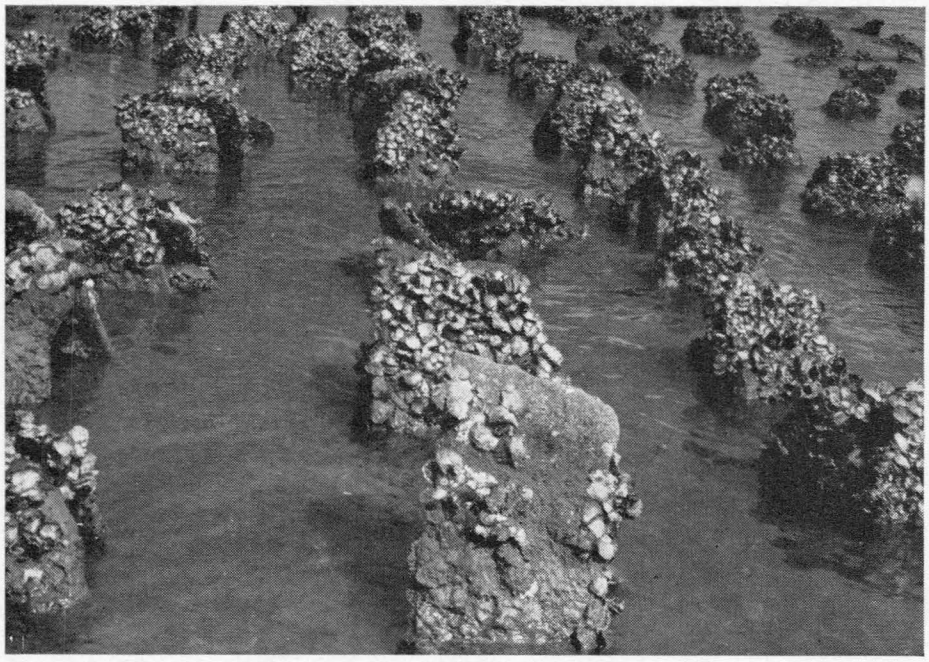

Oyster cultivation on sandstone slabs, Merimbula, New South Wales, Australia.

Oyster Farming

While oysters growing in their natural state are found in abundance around many islands of the South Pacific, the prospects for growing them commercially largely remain uninvestigated. This article describes the basic elements of oyster farming methods followed in the world's leading oyster-producing countries, which include Australia, Japan, the United States, France and Holland.

By J. M. THOMSON*

THE oyster industries of the world had their origin in simple reef-picking. For subsistence fishing for a small number of people this was sufficient, but as demand increased with growing populations, several shortcomings of the reef-picking system became evident. Firstly, oysters of all sizes are found in clumps, one on top of another. To get one oyster of reasonable size, several smaller oysters have to be chipped from the clump, and most of these are lost either because they are damaged in the chipping or there is no means of anchoring them again to the reef. Any increase in the area of production was impossible, as all suitable bottoms already had their oyster reefs. The only way to increase production to meet demand was to develop methods of cultivating oysters.

Oyster farming was started by a Roman in 195 B.C. While only a minor industry in Italy, today it has become very important in some other countries. Along the east coast of Australia, in Japan, the United States, France and Holland, oyster farming is big business.

Farming pays better than simple reef-picking because (i), the death rate can be reduced; (ii) the growth rate can be improved; (iii) oysters of a more or less uniform size can be kept together; (iv) pests can be more efficiently controlled; (v) more oysters can settle where clean silt- and slime-free surfaces are provided; (vi) bulk handling methods increase efficiency and so reduce the costs of operation; and (vii), use can be made of areas where oysters are not found naturally.

In its simplest form, oyster farming consists of taking oysters from areas where they settle naturally, but are overcrowded or die too quickly, to re-lay them on firm bottoms where they can be given more room to grow. Such bottoms may be inter-tidal or completely submerged. Submerged beds are usually harvested by dredging, though a method involving the use of long wooden tongs was formerly used to reach the oysters in parts of the eastern United States.

From such methods it is but a short step to artificial firming of soft bottoms in order to increase the area available for re-laying. To be firmed economically the bottom should be soft only to a depth of 2′. Beneath this there must be a layer of firm sand, rock, dead coral or dead shells; otherwise the firming material will sink below the 2′ level, requiring an uneconomical amount of filling.

Making A Shell Bed

The area of the proposed bed should be marked out with stakes—the exact dimensions do not matter. This area can then be covered by filling material such as rocks or shells. Most popular in Australia, where this method is sometimes practised, are boughs and twigs from nearby trees, the tea-tree *Melaleuca erocifolia* and the swamp oak *Casuarina glauca* being most favoured.

Outside the boundary of the bed, channels are dug in the mud till the firm layer is found. This material is shovelled on to the timber so that the bed becomes raised about 1′ above the surrounding bottom. The surface is raked level and the bed is left to settle. After some weeks a final layer of old, clean shells—preferably sun-bleached—can be added, and the bed is then ready for oysters.

The bed will need raking over periodically to free the silt which tends to settle out. If this is done during a good run of tide over the bed the silt will be carried away; otherwise buckets of water or spray from a hose will wash it away.

The surrounding ditches from which the solid top layer was dug should be kept open, and any sinking of the bed should be corrected by adding more solid material.

In the more advanced oyster-farming countries, techniques have gone far beyond the shell-bed phase of farming. Instead of removing the natural reef-oysters, movable artificial surfaces are set out so that the catching capacity of an area is increased many-fold. The mobility of the catching material (termed 'cultch' by oystermen) enables the young oysters to be removed from densely-caught areas to places where trial or observation has shown that oyster growth is good. Provision of artificial cultch also increases the area of the catching sites, for it has been found that oysters can be caught far from natural beds, their previous absence simply being due to the lack of a firm substrata suitable for settlement.

Growing areas have been increased, not only by firming bottoms for shell beds but also by providing other means of raising oysters above bottoms which naturally are so soft that the oysters would sink into the mud and be smothered. This can be done either by supporting the oysters in some way upon racks built to stand above the mud, or by suspending them from rafts.

Cultch Materials

Although naturally-caught oysters can

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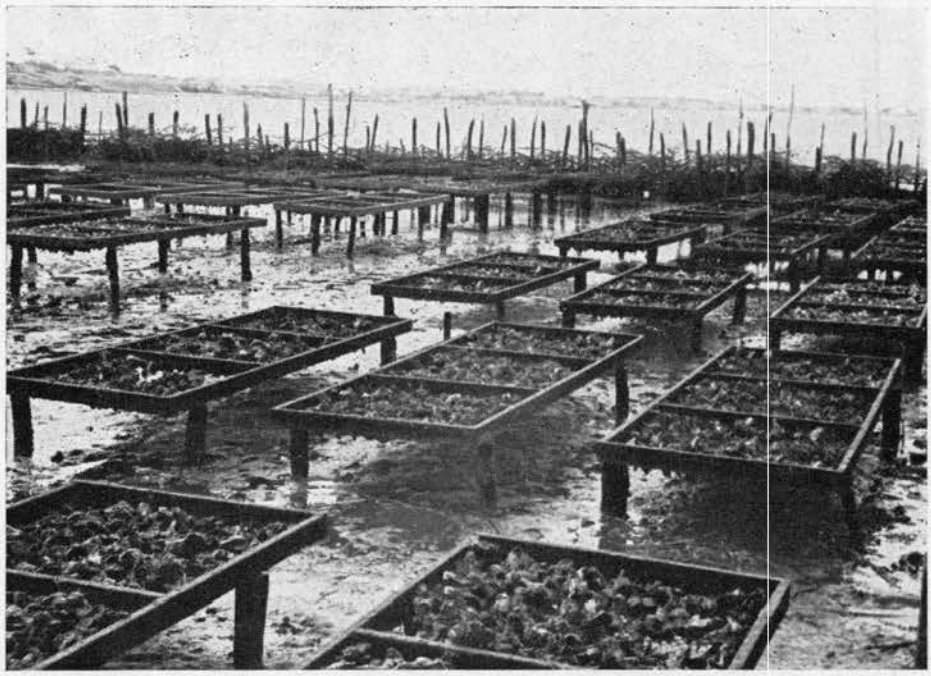


Tray cultivation, George's River, New South Wales. Separate supports are used instead of the more usual racks on which trays are placed side by side. Note the brush fence in the background to break the wash of the waves.

be transferred later to oyster farms, the oyster farmer is well advised to catch his own spat wherever possible. The method adopted depends upon the subsequent type of cultivation and upon the local abundance and price of materials.

To be successful, a cultch material needs to have a surface which is finely roughened, free from slime such as bacterial films or filamentous seaweeds, and it should not produce secretions such as gums or resins which might be repugnant to the oysters. The cultch must also retain the oysters either to harvestable size or to a size where they can be transferred successfully to other methods of cultivation. The cultch itself must be resistant to wave action or attack from boring organisms such as shipworm.

When the oysters are to be harvested they must be separable from the cultch without breaking the oysters. If rock is used as a cultch material, only soft rocks such as sandstone should be selected. Oysters can be separated from hard rocks such as granite only with difficulty, and most of them will be smashed in the attempt.

Any material that satisfies the above requirements, and is plentiful and cheap, can be used as a cultch material. The following are commonly used in the main oyster farming countries: Shells—mostly old oyster shells but also scallop and other shells (U.S.A. and Japan); terracotta tiles coated with lime (France, Holland); timber such as bamboo (Japan); black and orange mangroves, black wattle and white cypress, sawn and tarred timber slats, fibro-cement slats, sandstone (Australia).

Shell Cultivation

Shells can be broadcast on to firm bottom to catch spat (the young oyster at the stage of settlement). This is often done on submerged dredge beds so as to replace the cultch removed by harvesting the oysters.

Better catches are made by more controlled methods. In parts of the United States and Canada, old oyster and scallop shells are put into wire baskets about 2′ 6″ long and 18″ in diameter. These are stacked upright, usually in the intertidal zone.

In Japan and parts of the Philippines, oyster and scallop shells are strung on 13-gauge galvanized wire. The strings of shells are set out to catch, hanging vertically into the water either from racks or rafts. The length of the string varies according to the local situation. If the oysters are to be transported any great distance before setting out to grow, the Japanese oyster farmers have found it necessary to place the strings horizontally between tide-marks for hardening off before the shells are taken ashore for packing.

In Canada and parts of the United States, many oysters are caught on good quality egg-crate fillers which are dipped in a mixture of equal volumes of cement, slaked lime and moderately fine sand, then bundled, usually four at a time, in a heavy-gauge wire netting. These may be set out inter-tidally on mud-flats, but the catch is usually better when the crate fillers are suspended from a raft. These collectors later can be broken up either by hand or by a hand-made threshing machine, and the separated oysters can either be broadcast on firm bottoms or used in tray cultivation.

Stick Cultivation

Sticks can be set out in bundles on racks built of 2″ x 1″ hardwood held at catching level by 2″ x 2″ uprights stuck in the mud bottom. The distance between the runners of the rack varies according to the length of the sticks, but usually is from 2′ to 3′. Sticks can also be pushed into the bottom, either vertically or at an angle, but the catch is uneven along the length of the stick in such circumstances.

Natural timber can simply be bundled in lots of ten to twenty sticks, bound together by heavy gauge wire. But sawn timber slats (which need to be dipped in tar) are best nailed in a framework where 1″ battens are nailed 6″ apart on two cross battens, and then piled in a battery so that the battens of one frame fit between those of the frame beneath. After tarring they should be weathered

Scraping one-year-old spat from lime-coated tiles, Arcachon, France.

A low fence with projecting horizontal top to prevent access by crabs.

in the sun for two weeks before setting out; otherwise the tar seems to be toxic to oyster larvae. Fibro-cement slats can also be set out in batteries, the slats being separated by a slat set at right angles to the main system.

Oysters caught on sticks are usually cultivated this way to selling size, the sticks being nailed out singly and the battery of slats set out, a single frame on a rack, about twelve-sixteen months after setting out to catch. Up to this stage it is advisable to keep the cultch in bundles to prevent fish feeding on the young shellfish. If sticks do not last the required time or are accidentally broken, or if oysters fall off, the oysters can be put on to trays or set out on shell beds.

Rock Cultivation

Blocks of sandstone or loose shale about 2′ x 1′ x 4″ can be set out to catch, either by piling two or three stones on end at an angle of about 70° to the bottom, or by raising the stone above the bottom on a platform of hardwood timber or on racks similar to, but narrower than, those used for sticks. Or they may be held above the bottom on tripods of small stakes thrust in the ground.

They are set out in rows so that a man can walk easily between them, and between every ten rows a wider channel should be left to permit a boat to pass. The spat catch mostly on the underside of the slabs.

If a heavy catch is made in spring or early summer the stones are turned over the following year. But if the main catch is in late summer the young oysters will not be tough enough to withstand marauding fish the following spring, and the stones cannot be turned for a further year.

Tray Cultivation

The tray method is used in conjunction with one or more of the methods used to catch the spat. Generally oysters are held in the trays only nine to twelve months before marketing so they are fairly advanced in growth before being trayed.

Trays may be of any size. Those used in Australia are usually about 9′ long and 3′ wide; 3″ x 1″ timber is used. The 3′ end-pieces are nailed on the 9′ side-pieces so that the shorter pieces overlap the longer. The mesh of wire netting depends on the size of oyster to be set out; usually $\frac{3}{4}$″ mesh is used, but it can range from $\frac{1}{2}$″ to $1\frac{1}{4}$″. It should be of the heaviest gauge obtainable. The wire is stapled to the outer frame of the tray and then the two 3′ spreaders are forced in between the long side-pieces, thus both tightening the wire and dividing the tray into three compartments, each approximately 3′ square.

The trays are tarred to protect the timber from shipworm and the wire from corrosion. It is claimed that cold tar seals the wire better where it twists, but hot tar penetrates the timber better. The tarring is best done by dipping in a tank made for the purpose.

Maintenance

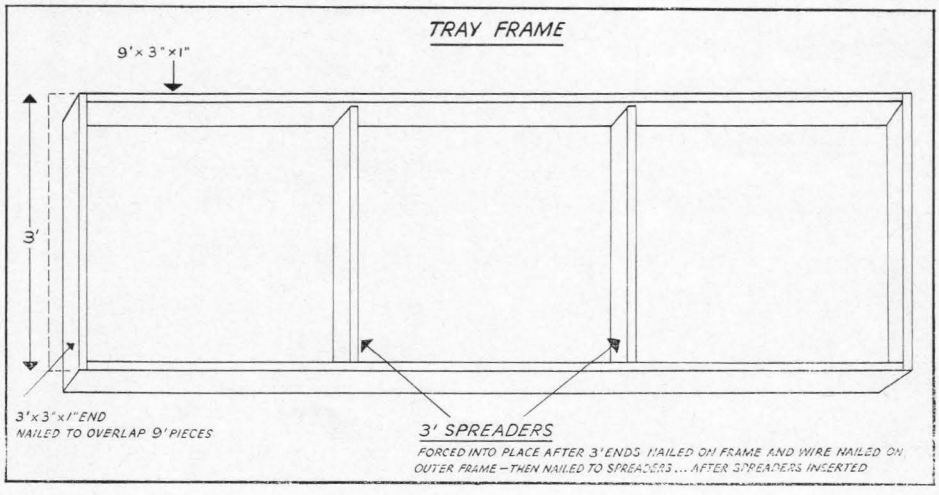
In most places it takes three or four years to produce an oyster large enough to be worth eating, though there are small areas where two years is sufficient. Where oyster farming is most profitable it is a full-time business. In reef-picking, the oysterman takes what nature leaves after three or four years.

In farming, careful maintenance will multiply the number of surviving oysters many times over. Pests such as starfish and boring whelks have to be guarded against and removed from the beds. In some places it has been necessary to build wire fences to keep out rays and other fish. In Arcachon, in France, little fences about a foot high are built to keep out crabs which move across the bottom. Regular inspection is necessary to keep racks and trays in good condition. Breakwaters may have to be built to stop wave action washing oysters from trays or breaking sticks.

When oysters are marketed they should be culled beforehand and small ones returned to trays or shell beds for further growth.

Observation of local natural oysters will indicate the best levels for catching and growing. If hot sun tends to stunt growth, the oysters should be put well down in the inter-tidal zone. Only local knowledge can tell when cultch material should be put out to catch the spat. This

(Continued on page 70)



Details for constructing a tray frame are shown in this sketch.

Shell Money Makers Of Malaita

Auki Island, off the west coast of Malaita. This tiny islet—one of a chain extending along the coast—was built up artificially from coral blocks. Below: View of Auki Island from the mainland.

The people living on the tiny, man-made coral islets along the coast of Malaita Island, in the Solomons, are highly-skilled makers of shell money. Originally made for bartering purposes, shell money is used nowadays only on important occasions such as a marriage, compensation for injury or offence, or for gifts to medicine-men or craftsmen.

By R. J. A. W. LEVER

ALONG the coasts of the narrow, 120-mile-long island of Malaita in the British Solomon Islands is a series of tiny coral islets. Close examination of these will show that they are not natural features, but are man-made from blocks of coral limestone. These were collected on bamboo rafts and laboriously built up above high-water level to form a foundation for homes.

It is believed that the ancestors of the present people were immigrants who arrived about two and a half centuries ago. They found the coastal land already occupied, and so decided to build their own small islands on which to settle.

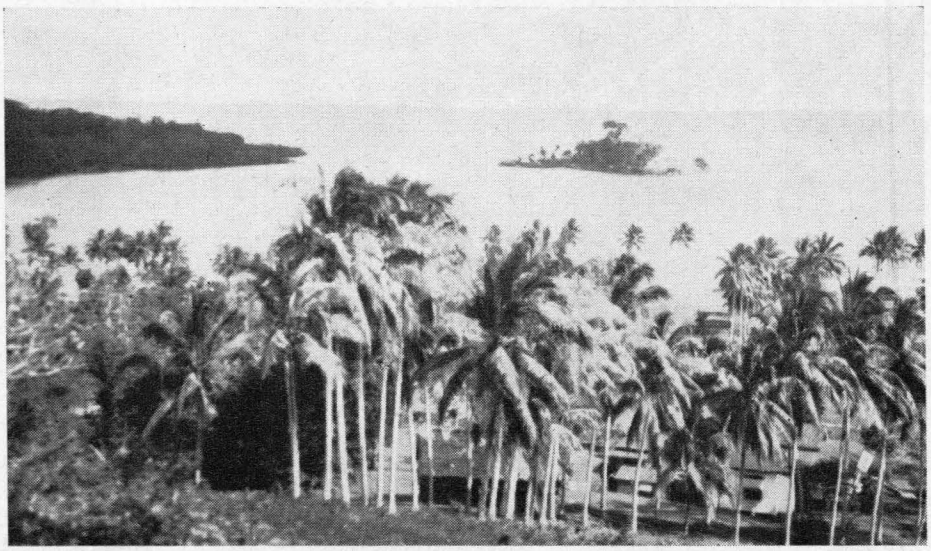
The best known of these islets is Langalanga, near the local seat of Government at Auki, on the west coast of Malaita, which is separated from the Florida Group of islands by Indispensable Strait.

By the time houses were built and a few small gardens planted with crops there was very little space left, and so the inhabitants decided to specialize and sell their handcrafts—somewhat like the Swiss. However, instead of making watches and clocks they started a mint and made shell money, which they took by canoe to adjacent islands and other parts of Malaita to barter for pigs, fruit and vegetables.

Shell money is made primarily from small pieces of a marine shell called the thorny oyster (*Spondylus*). This bivalve occurs on certain coral reefs, and the islanders gather it by diving for it. The colour varies from a brick red to a raspberry pink—hence the alternative name of "red money". Only the curved lower half of the oyster is used in this industry.

Men And Women Work In Turn

The work calls for a good deal of skill and perseverance. Different stages are carried out by the two sexes. First of all the shells are roughly broken into small, round portions by the men. The womenfolk then paste the fragments into grooves in slabs of wood, where they are given a preliminary polish with sandstone.



The next stage—also carried out by the women—calls for deft handling, as it involves the boring of each piece of shell by means of a pump drill. This is a most ingenious tool, consisting of a vertical wooden rod fitted with a hard, flint-like stone for a bit, and with a "flywheel" of wood or stone. It is given a fast alternating circular motion by means of two strings tied at one end to the top of the drill rod, and joined at the other end to the two extremities of a short horizontal bar.

Starting with the strings wound around the top of the drill, the small bar is pushed down, unwinding the strings and spinning the drill and flywheel assembly. The strings wind themselves around the rod, the horizontal bar comes up, and is pushed down, to send the drill spinning, in the opposite direction this time.

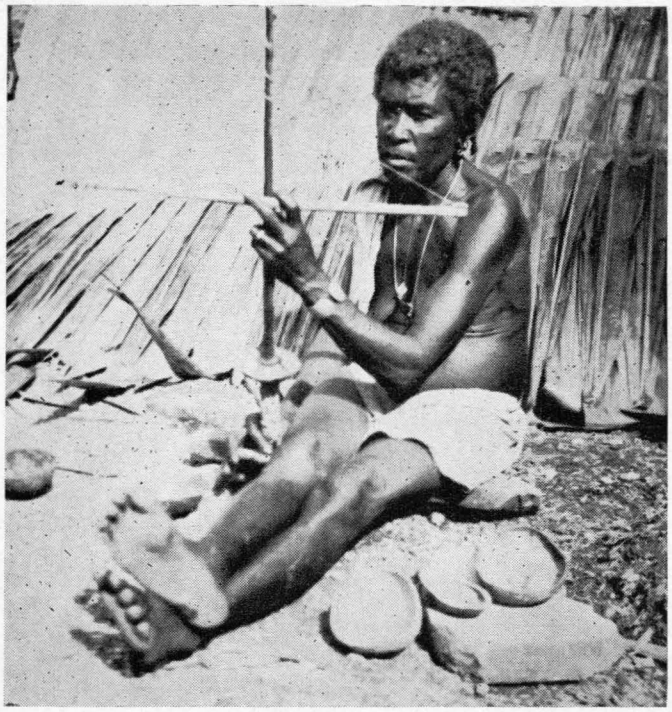
The principle involved is much the same as that of the simple toy, made of a loop of string and a button or small piece of wood, which children of all countries twist by pulling on both ends of the loop, producing a slight purring sound.

After this, the men take over again. Working in pairs, they thread a stout fibre through the bored pieces of shell and polish the edges with sand.

The final stage is the threading of the now uniform discs with a vegetable fibre thread, which is made up into fathom lengths measured from finger tip to finger tip across the outstretched arms. About sixteen discs go to the inch.

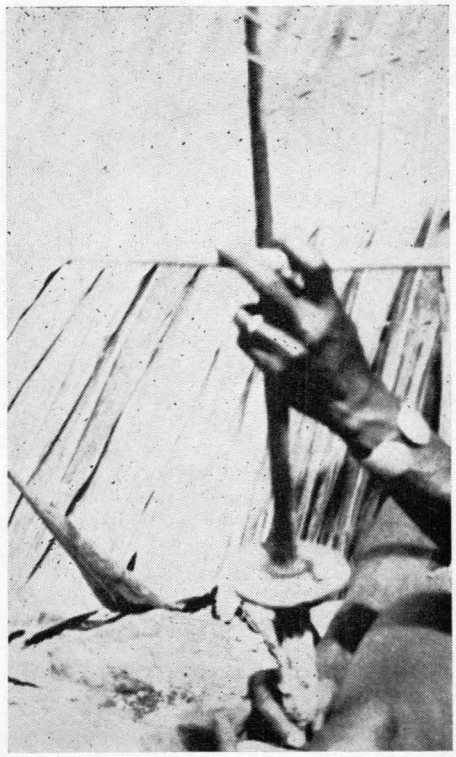
Not Used For Ordinary Trade

The purpose of the money is for use on important occasions such as marriage (from the bridegroom's to the prospective bride's parents), compensation for injury or offences, or gifts to medicine men or craftsmen. Shell money is not used in ordinary trade.

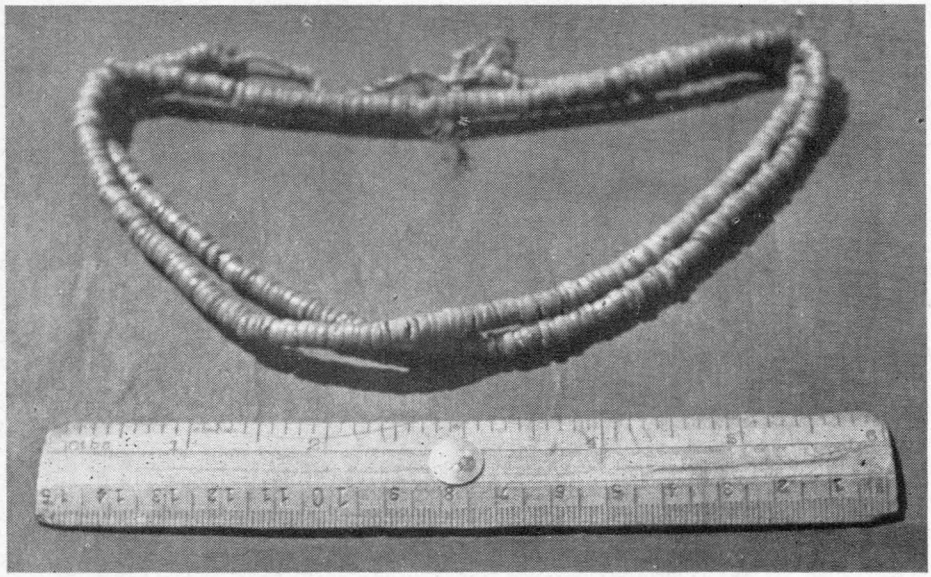


Left: Woman of Auki Island using the ingenious drill developed by the ancestors of her people for boring holes in shell.

Right: Close-up of drill. A pump-like action spins the bit, formed from hard, flint-like stone.



Below: Necklace of shell money. About sixteen discs go to the inch.



The value is estimated as 5/- per fathom string, of which twenty-eight would be needed for a pig (£5) and from 100 to 500 (£25 to £125) for a wife, according to her experience or expectations.

The value of shell money used to be based on official currency, though the war upset this; the Japanese troops just took the islanders' strings, while the United States forces paid more or less what was asked for them.

As time goes on, shell money will undoubtedly mean less and less to these people, as the advantages of normal currency become more and more apparent to them.

New Cash Crops For Owen Stanley Villages

The people of four villages high in the Owen Stanley ranges of Papua and New Guinea have built two airstrips from which half a ton of market produce is being flown each week to Port Moresby.

The villagers were helped with encouragement and advice from an agricultural extension officer, Mr. T. Brockhall, who also provided them with seeds of the European-type vegetables they are growing. These include potatoes, cucumbers, beans, tomatoes and cabbage, all of which are in brisk demand in Port Moresby.

The success of the project has encouraged the people of three other villages, two days' walk away, to build an airstrip for a similar purpose. They also have now been provided with seeds of European vegetables, and three are being shown how to plant and grow them by Papuan agricultural instructors, who have been stationed temporarily in the villages for this purpose.

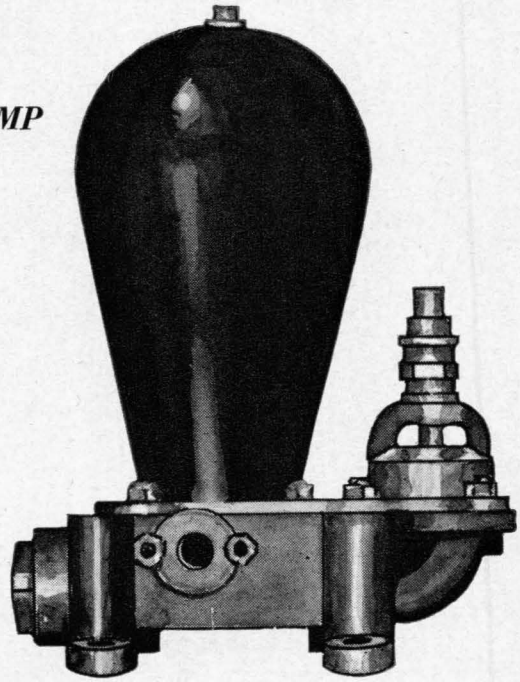
All seven villages are only twenty minutes' flying time from Port Moresby. In addition to deriving a regular income from their new cash crops, the villagers will be able to visit Port Moresby more often, and through this contact add to their own education and general development.

New Banana-Growing Scheme Launched In Fiji

With the main objective of stepping up production of bananas for export to Japan and New Zealand, Fiji's Land Development Authority plans to establish one hundred settlers on a 3,500-acre tract of land it has leased at Lomaivuna, about twenty-five miles from Suva.

Each settler will be allotted ten acres, four of which will be planted in bananas late in 1963 for an expected first crop a year later. As well, each settler will be encouraged to plant one acre in subsistence crops for his own consumption or sale locally. The Authority also plans to find a long-term cash crop or crops for the remaining five acres of each settler's holding. Among possible crops now being investigated is a high-yielding variety of rubber.

The Hydraulic Ram.. *AN EFFICIENT ENGINE-LESS WATER PUMP*



There is no cheaper method of elevating water than the hydraulic ram, and there is no other device that once installed needs so little attention. It could be much more widely used in the high islands of the Pacific than it is at present.

ALL proposals relating to the pumping of water involve four principal considerations: the vertical height the water has to be raised, the total distance it has to travel, the size of piping used for both suction and delivery, and the rate at which it is required to raise the water.

The vertical distance the water has to be elevated is called the static head. The resistance offered to the flow of water by the suction and delivery pipes is called the friction head. This must be added to the static head to determine the total pressure against which the pump has to work.

Given these particulars, it is a fairly simple matter to determine the size of pump and the horsepower of the engine required to work it.

No Engine Required

The hydraulic ram acts differently from any other type of pump, and does not require an engine to work it. That is to say, it provides its own power to force water to a higher level. The simplicity of the hydraulic ram is frequently mentioned—but it is simple and sufficient only when it is suited to the job.

The hydraulic ram will pump only a small proportion of the water that runs into it. If it is required to raise, say, two thousand gallons per day, seven to fourteen times that quantity must be fed into the supply pipe from the stream that feeds the ram.

The height to which the ram will force water depends on the head, or fall, into the ram, and also on the length and size of the pipe that leads the water into the pump. This pipe is called the drive pipe.

Drive Pipe

The size and length of the drive pipe must be in proportion to the head against which the ram has to work. Unless a larger pipe is used, to overcome increased friction, it is useless to obtain the requisite fall by extending the drive pipe beyond the length shown in Table 1.

If an abnormally long pipe is required to feed the ram, it would be better to feed the water into a tank or cistern, so placed that a drive pipe of a length specified in the table could be taken from this tank to the ram. Avoid any bends or curves in the drive pipe. This pipe should be straight from source of supply to the ram. The velocity of the water flowing down the pipe must not be restricted under any circumstances.

A good strainer is essential on the drive pipe at the source of supply, to eliminate the risk of foreign matter entering the ram.

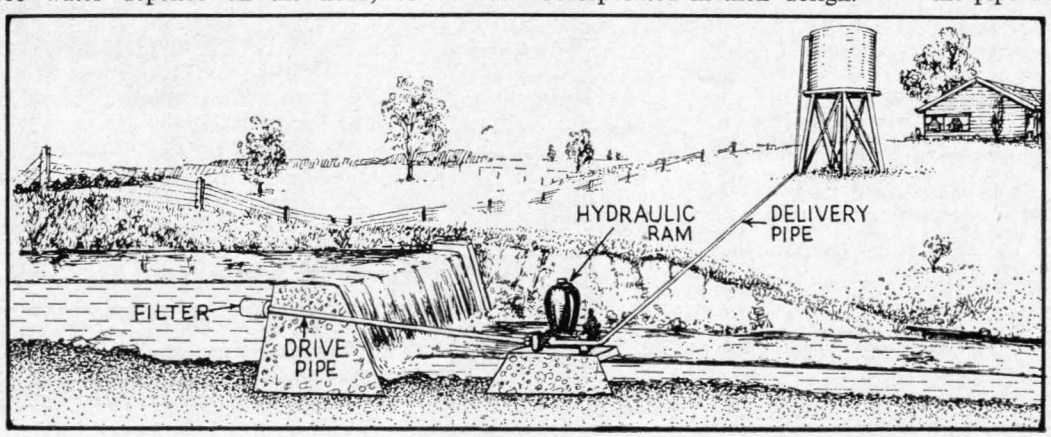
It is advisable to fit a "sniffle valve" in the drive pipe close to the ram, to prevent the air dome becoming waterlogged and so to maintain a constant air volume in the dome. This is only necessary on those rams that do not have such a valve incorporated in their design.

Handy Tables

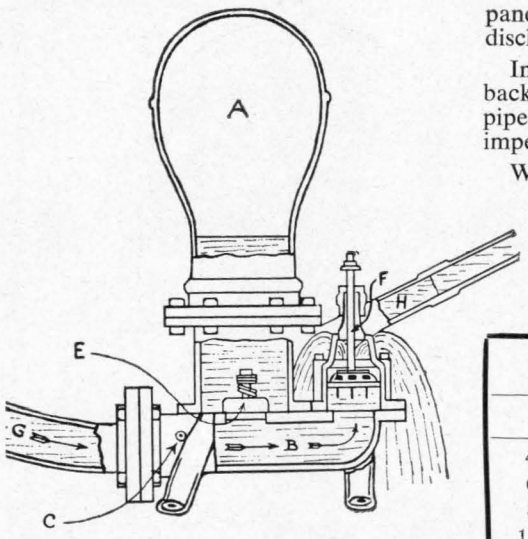
Table 1 will show whether the hydraulic ram is likely to be suitable for your requirements, and the conditions necessary for its satisfactory performance. The table shows the length and fall of the drive pipe required to force water to vertical heights of from 4′-200′.

Table 2 gives the quantity of water required to work the various sizes of rams and the proportion that will be forced through the discharge pipe. It also shows the bore of the drive and discharge pipes.

As an example: Suppose that the stream is capable of supplying the ram with 6 to 14 gallons per minute. Table 2 shows that the No. 5 ram will deliver 30 to 60 gallons per hour. This calls for a 2″ drive pipe and a ¾″ discharge pipe. Suppose further that the ram has to elevate the water to a vertical height of 48′. Table 1 shows that for a 48′ head it will be necessary to place the ram under a fall of 6′ and that the length of the pipe drive should be 40′. (Note that



Typical installation of an hydraulic ram.



Working diagram of an hydraulic ram. An explanation of the principle involved is given in the text.

the length of the drive pipe somewhat approximates the vertical height the water is to be elevated.)

The sizes of the discharge pipes given in the tables are sufficiently large as to make it unnecessary to take friction head into account. This is largely because hydraulic rams pump at a very slow rate compared with power-driven pumps.

How The Ram Operates

The accompanying drawing is a section of a well-known make of hydraulic ram. It illustrates the principles involved in other makes.

It consists of an air chamber "A", body "B", and air sniffle valve "C", check valve "E" and impetus valve "F". The drive pipe is "G" and the discharge or delivery pipe is "H".

When the impetus valve "F" is down from its seat, water from the drive pipe flows through "B" and out to the waste through "F". As the flow gains velocity, its pressure becomes great enough to lift the impetus valve and force it against its seat, thereby closing the opening.

At this stage the velocity of the water in the drive pipe has become so great that the sudden stoppage at the valve "F" causes it to hit hard and force open valve "E". In so doing, it squeezes the air in chamber "A".

Almost immediately the air in the chamber expands again, exerting pressure and starting to push the water back. This force assisted by the spring on the valve, closes valve "E". The expanding air then forces the water up the discharge or delivery pipe "H".

Immediately the valve "E" closes, a backward surge is created in the drive pipe, and relieves the pressure on the impetus valve "F", which drops open.

With this valve open, the water begins to flow in the drive pipe until its velocity becomes so great again that it lifts the valve "F" back on to its seat and shuts off the flow, and the cycle is repeated as before.

With every surge in the drive pipe a slight amount of air is drawn in through the sniffle valve "C". This is forced into the air chamber "A" and eliminates the possibility of the chamber becoming waterlogged or completely filled with water.

The hydraulic ram is most efficient when the volume of the air chamber is equal to the volume of the discharge pipe. Therefore, the larger rams are best suited for long-discharge pipes, if there is enough water to operate them.

Installation

When a drive pipe is excessively long, it is advisable to install a cistern or reservoir to give the exact length and height of drive pipe. These cisterns where installed should be covered with a perforated cover, preferably zinc, to intercept leaves.

Usually, installation of a hydraulic ram involves constructing a small dam or weir across a stream and placing the drive pipe in it.

A solid concrete block is necessary as a foundation for the ram to withstand the vibration caused by the pounding of the impetus valve. A gate valve is recommended on both the drive and the discharge pipe to avoid the necessity of emptying them when cleaning or making repairs. A good strainer is recommended for the drive pipe at the source of supply, to prevent foreign matter entering the ram.

TABLE 1

To Deliver Water to a Height of . . .	Place Ram Under . . .	Conducted Through . . .
4′ above ram	2′ head or fall	12′ of drive pipe
6′ „ „	2′ „ „ „	12′ „ „ „
8′ „ „	2′ „ „ „	12′ „ „ „
15′ „ „	3′ „ „ „	15′ „ „ „
25′ „ „	4′ „ „ „	20′ „ „ „
35′ „ „	5′ „ „ „	30′ „ „ „
48′ „ „	6′ „ „ „	40′ „ „ „
63′ „ „	7′ „ „ „	50′ „ „ „
80′ „ „	8′ „ „ „	60′ „ „ „
100′ „ „	10′ „ „ „	75′ „ „ „
120′ „ „	12′ „ „ „	95′ „ „ „
140′ „ „	14′ „ „ „	110′ „ „ „
160′ „ „	16′ „ „ „	125′ „ „ „
180′ „ „	18′ „ „ „	146′ „ „ „
200′ „ „	20′ „ „ „	160′ „ „ „

Adjusting The Impetus Valve

When the ram is installed, it is necessary to adjust the impetus valve to suit local conditions. Its stroke is altered by screwing the adjusting nut up or down. After the valve has been adjusted it is important that the locknut be screwed up tight.

If the valve is subject to undue knocking, it could be damaged and lead to a mechanical breakdown. Severe knocking is overcome by fitting lead washers to the impetus valve. All impetus valves working to capacity should be counterbalanced in this way.

To start up a hydraulic ram, it is necessary to hold the impetus valve down for a few seconds and allow the water to run to waste. Then allow the valve to rise and shut off the flow of water. It may be necessary to repeat this on several occasions before the ram will start automatically.

TABLE 2

Size of Ram	Drive Pipe	Discharge Pipe
No. 3 requires 1¼-4 gals. per min., delivers 10-20 gals. per hr.	1″	½″
No. 4 „ 3-7 „ „ „ „ 15-35 „ „ „	1¼″	½″
No. 5 „ 6-14 „ „ „ „ 30-60 „ „ „	2″	¾″
No. 6 „ 12-25 „ „ „ „ 55-100 „ „ „	2½″	1″
No. 7 „ 20-40 „ „ „ „ 100-200 „ „ „	3″	1½″
No. 10 „ 25-100 „ „ „ „ 125-500 „ „ „	4″	2″

* This article appeared originally in *The Agricultural Gazette of New South Wales* for March, 1962. It is reproduced here by special permission.

Agriculture On Rotuma Island

Lying midway between Fiji and the Ellice Islands, well off the main shipping routes, is Rotuma Island. Part of the British Colony of Fiji, it is a small island about nine miles long and two miles wide. Agriculturally it is somewhat unique among Pacific islands in that mixed farming (crops and livestock) is widely practised, and there is little unused land.

By R. L. HARTLEY*

Above: Approaching Rotuma Island from the south-east.

Left: A typical quiet sandy beach on Rotuma.

ARE there many truly remote islands left in this world of modern travel and communications? Rotuma, although in contact with Fiji by radio telephone, can claim with some justification to be still remote and isolated. It is off the main shipping routes, and a small boat blown out to sea from Rotuma in a sudden storm would have a slim chance of making a landfall again, compared with one from a typical island in the Fiji Group proper.

To catch large fish it is necessary to go outside the reefs, and, in uncertain weather, risks are taken in so doing.

Rotuma lies at a point 12°30′ south latitude and 176°40′ east longitude, and is some three hundred miles from the nearest land. It is about midway between Fiji and the Ellice Islands, and also about midway between Samoa and the Santa Cruz Group of the Solomon Islands.

At first glimpse on the far horizon, Rotuma appears like two humps rising sheer out of the sea. First impressions on arrival tend to be a realization of one's general idea of a South Sea Island paradise, with deep blue sea and foaming white surf on the reef, multi-coloured waters within the lagoons, clean white sands, coconuts and lush green vegetation, and, of course, glorious sunshine and blue skies. Yes, the Polynesian people, too, are charming, handsome and hospitable.

A Small Island

Rotuma, part of the British Crown Colony of Fiji, is a small island, approximately nine miles long with an average width of about two miles. While most of the coastal areas are either flat or gently undulating, there is high, steep land in the interior and also on one of several nearby tiny uninhabited islets (hence the two humps referred to earlier).

There are forty-two clean, tidy villages, all located on the coast. They are dispersed at short distances alongside a good road which runs right around the island.

Rotuma Island is divided into seven districts — Itumuta, Ituitu, Malhaha, Juju, Pepjei, Noatau, and Oinafa. The Government station and residency of the District Officer, an able Rotuman, are located at Ahau in Ituitu District. The District Officer is responsible to the Commissioner Eastern, who is stationed at Levuka, Ovalau, in the Lomaiviti Group of Fiji proper.

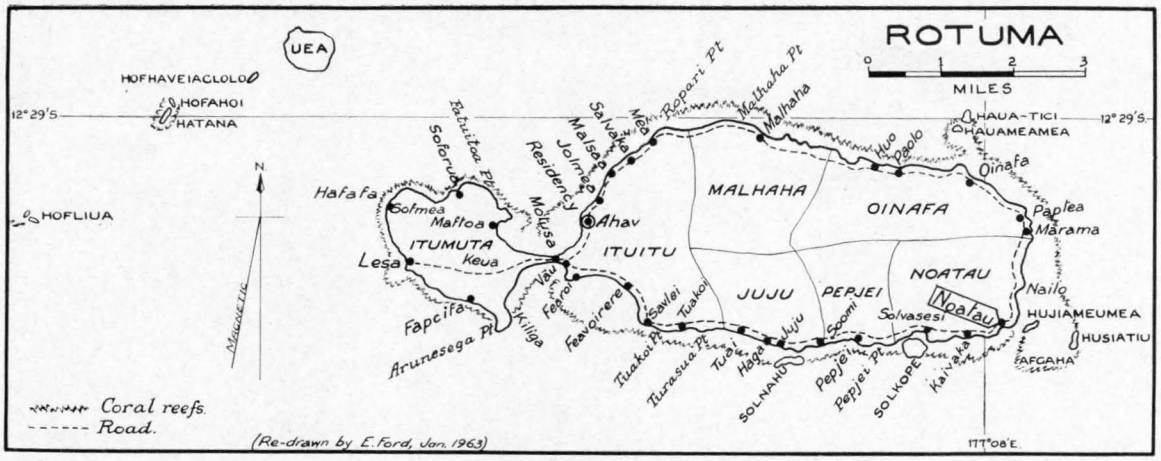
Rotuma, notwithstanding its administrative ties with Fiji, is in many respects like a different country altogether—with its considerably hotter climate, its people, language, houses of gleaming, white-walled concrete or lime, with corrugated iron roofs and water catchment tanks, cemeteries with huge tombstones, free bus services, modern co-operative stores, hot-air type copra driers in every district, and stonewall fences.

The language resembles other Polynesian languages, particularly Samoan, but differs markedly in one respect in that it actually includes a number of Chinese words (Cantonese).

Over-Population The Main Problem

Agriculturally, Rotuma is also somewhat unique as a Pacific island in that mixed farming (crops and livestock) is

* Agricultural Officer, Department of Agriculture, Fiji.



Map of Rotuma Island, showing locations of the main villages. There is high, steep land in the interior, and also on one of the several tiny, uninhabited islets nearby.

the general rule rather than the exception, and in that it is difficult to find any waste, unused land. Undoubtedly the large population, which is still rapidly increasing, coupled with the remoteness of the island and consequent high cost of importing foodstuffs, are all contributing factors.

High population is Rotuma's number one problem—in 1961 it totalled 5,195—and already a small planned migration project has been implemented. Farmers have been settled on some undeveloped land alongside the new Sawani-Serea Road on Viti Levu, Fiji.

There are no truly independent farmers on Rotuma. Agriculture is conducted on a communal basis, with its inherent disadvantages for economic progress. However, these are reduced to a large extent, due to the well-organized and efficient co-operative societies which flourish throughout the island, and which form part of the central co-operative organization for the whole of Rotuma, with its headquarters at Noatau. A noteworthy export and import business has been built up, and there is a large, modern, well-stocked shop with a wide range of attractively-displayed goods, a warehouse and office. Turnover is now over £F11,000 per month.

Copra is the one and only regular export commodity. It is, of course, the most suitable product on which to concentrate, due to the general suitability of soil, topography and climate, and due to the comparatively non-perishable nature of efficiently-made copra.

Vessels from Fiji visit the island around every six weeks.

Soil, Climate, And Crops

Rotuma is of an ancient volcanic origin. The soil type varies from a sandy loam to loam, of considerable depth. While fertile, there are some areas where it is thin and covered with stones and boulders. In the hilly interior there are limestone outcrops and numerous bat-inhabited caves and craters.

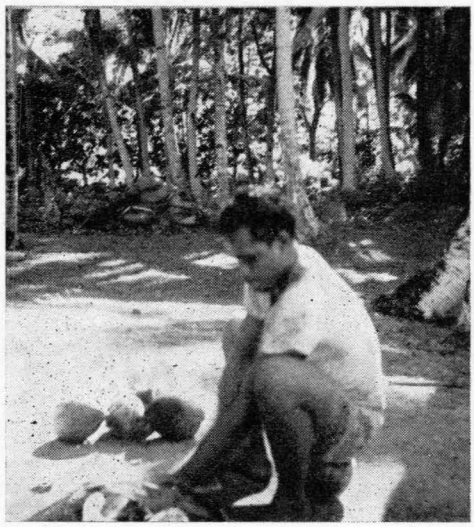
Rainfall averages 139.89 ins. per annum, and although it falls mostly between the months of November to April, it is nevertheless fairly well distributed throughout the year. Sea breezes on the coast mitigate to some extent the somewhat oppressive heat.

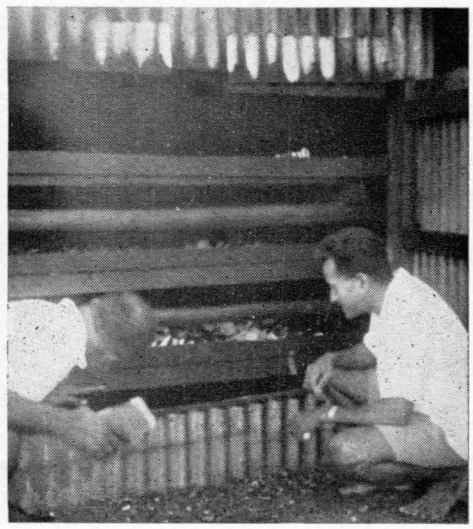
This combination of favourable soil and climate makes it possible to produce a wide and bountiful range of agricultural products. Rotuma is, indeed, famous for its "king-size" coconuts (NIU), delicious juicy oranges (MORI), and huge yams (UHI). Some idea of the size of the coconuts may be gained from the fact that, normally, eighty nuts are sufficient to produce about ninety pounds of green copra, which in turn means that only a little over 3,600 nuts are required to produce one ton of dried copra.

Copra is collected in capacious round baskets which are quickly made from coconut fronds. These are carried to convenient loading points alongside the main road, and to the many feeder roads leading therefrom.

Copra cutting is done by both men and women, and their dexterity is impressive. A shortened, narrow-bladed

Below: Cutting copra. Rotuma is famous for its "king-size" coconuts. Centre: Copra baskets and vata, or drying racks. Right: Typical "Kukum" type copra drier, now popular on Rotuma. At right is Rotuman Field Officer Kafoa Fakvai.





cane knife, razor sharp, is the only tool used. Two well-placed sharp blows halve the nuts in husk, and then the green copra is scooped out in one whole piece and flicked with the knife into the baskets arranged alongside. The whole operation is done remarkably quickly, the result of incessant practice.

Lorries collect the baskets and transport them to the nearest *vata* (drying shelves) and copra driers. Every effort is now made to get the copra to the driers on the same day as cutting. The lorries, however, usually carry uneconomical loads, and petrol is expensive. Carts, as in Tonga, would probably be more economical, as there are plenty of horses.

"Kukum" Driers In General Use

"Kukum" type copra driers are now in general use, and are efficiently managed. Copra production is on the increase, and approximately 3,100 tons are produced annually, a figure which must make some islanders, with similar resources and circumstances, ponder.

A Tongan vessel commenced collecting copra in 1962 at considerably reduced freight rates. A Rotuman Field Assistant (now Field Officer), Kafoa Fakvai, found difficulty in convincing his people that hot-air driers were essential for the processing of good-quality copra in areas of such high rainfall as Rotuma. However, the first "Kukum" hot-air drier[1] was built at the Catholic Mission's property, Sumi, under his supervision. The co-operative organizations were quick to follow suit, as they soon received concrete evidence of increased returns obtained from superior copra.

Kafoa attended the Methodist Mission's Navuso Agricultural School and the Koronivia Farm Institute, Fiji[2]. He graduated from these two institutions in 1953 and 1955 respectively, with a highly satisfactory academic record. Thereafter he worked as a Field Assistant in various parts of Viti Levu, Fiji, until he was posted temporarily to Rotuma from May 1959 to June 1962.

His numerous duties included supervision of the construction of many of these hot-air driers, a determined drive to clean up coconut plantations heavily infested with weeds, and advising on improved storage facilities and sanitation for copra. His efforts had a profound effect on the overall improvement of, and increased revenue from, copra.

His other multiple duties included produce inspection, with particular emphasis on the examination of all incoming vessels for the rhinoceros beetle (*Orcytes rhinoceros*), acting as general agricultural and veterinary adviser to the Rotuman Council and to farmers generally, implementing the Livestock Improvement Ordinance relating to bull licensing, etc. He was also meat inspector, and general veterinary practitioner, while it was also his duty to train local leaders to carry on various aspects of work after his departure from the island.

Above: Lantana control by M.C.P.A. spraying. Right: Secondary growth after initial weed control operations. Note crowded palms in background, typical of Rotuman plantations.

All in all, Field Assistant Kafoa's work-a-day life hardly represented the tourist's popular conception of the "happy-go-lucky" islander lazing away the day under a coconut palm!

Copra production, from the time of cutting to processing and exporting, is now quite efficient, but attempts at cleaning up coconut plantations have met with only partial success. The main reason for this is that the various people of the districts all clamoured for their areas to be attended to at once—or at least as quickly as possible—instead of agreeing to the selection of limited areas, concentrating efforts with all available resources, and following the work up at timely and regular intervals to ensure ultimate success. This desire to tackle large areas of bush clearing or of planting work far beyond what can be subsequently followed up and maintained seems to be a common failing in many Pacific Islands.

However, initial clearings had an important value in convincing the people about the increased production of copra—and incidentally of oranges—resulting therefrom. Statistics were unnecessary, because all were aware of previous average production of baskets of copra from their own areas, and it was thus a simple matter for them to compare the increasing number of baskets produced.

A great deal more improvement would result if the far-too-closely-spaced coconut palms were drastically thinned out to 30′ spacings, and if old unproductive palms were replaced with carefully-selected, nursery-raised seedlings. However, the only hope of convincing people with a widely-held belief that the more coconut palms there are to the acre, the more nuts will be produced, is to give them proof that they are wrong. The only really satisfactory way to furnish this is to run a demonstration block of preferably three acres of well-managed plantation, alongside a three-acre block under normal Rotuman management.

Too many germinated nuts are used for copra making, and insistence on the rejection of all such nuts would greatly improve the final product.

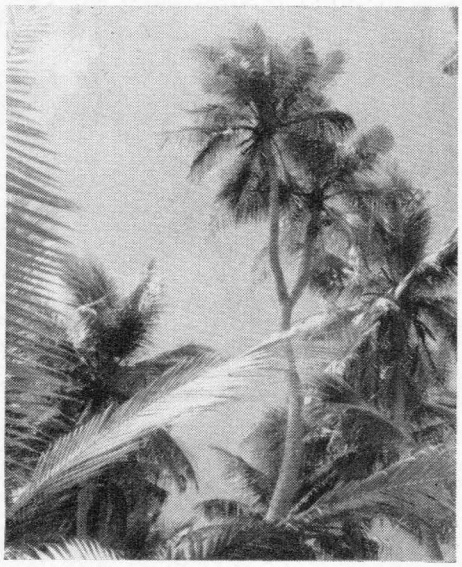
Damage to coconut fronds by the larvae of the flat moth (*Agonoxema argaula* Meyr) appears to be heavy, but recent research work by Fiji entomologists has indicated that the use of insecticides against the pest, even on young palms, is uneconomic.

Although present on Rotuma, no serious damage has been done yet by the coconut stick insect (*Graffea crouani* Le Guillau). An insect (*Taleonemia scrupulosa*) introduced many years ago for the possible biological control of the weed *Lantana camara* is still established, although it is of little value since lantana, together with *Hibiscus tiliaceus* (HAU), are the two most heavily-infesting weeds at present. Many other weeds are as found in Fiji proper, and include *Psidium guajava* (KUAVA), and *Sida acuta* (FINAK NE PUAKA), which are widely distributed, although not in very heavy infestations. The troublesome mint weed (*Hyptis pectinata*) and "mile-a-minute" (*Mikania micrrantha*) are, unlike in Fiji proper, comparatively rare, while *Piper aduncum* is conspicuous by its absence.

After the weeds have been cleared, reasonably good grasses of an aggressive nature such as Batiki blue (*Ischaemum aristatum*) and carpet grass (*Axonopus compressus*) are not given a chance to become established, due to uncontrolled

[1] See Fiji Department of Agriculture *Bulletin No. 32* for further information.

[2] *See South Pacific Bulletin* for January 1963 for details of the latter institution (now the Fiji School of Agriculture).



Above: Coconut palm attacked by termites. Right: An unusual phenomenon—a branched coconut palm.

grazing (the land is never spelled), and due to the lack of timely follow-up weed control work already mentioned. Nevertheless, a small quantity of Batiki blue grass and centrosema was brought to Rotuma on the occasion of my visit in 1962. A quantity of dadap was also brought in case it was required for the provision of shade for cocoa, and for fence lines, etc.

A common local grass (*Cyrtoccum trigonumi*) contributes but little for pasturage. The Peruvian strain of leafy *Leucaena glauca* planted in fence lines, and even between the coconut palms, would be worth while introducing, although supplies of planting material are at present in short supply.

Other quick-growing trees such as *Albizzia falcata* should be planted along fence lines—for example, along the boundaries of the seven districts of Rotuma, and possibly along village boundaries. Such trees would in due course help to replenish the timber which is now being used regularly and in large quantities for firing the copra driers.

Rotuman Oranges Superb

The superb quality of Rotuman oranges must be seen and tasted to be fully appreciated. It is difficult to imagine how man's aid in the form of careful plant selection, budding, pruning, fertilizing, and pest control, could surpass nature's feat of creating such healthy, heavily-laden trees, mostly as a result of seed dispersal from fallen rotted fruit or from man's accidental agency by the spitting out of seeds as the fruit is eaten. The oranges bear all the year round, and on a typical tree at any one time there are flowers, young small fruit, half grown and mature fruit. The peak period of production, however, is from March to May.

Oranges might well provide a secondary export commodity, for export either to Fiji proper or even elsewhere, since serious diseases such as citrus canker do not exist in Rotuma.

During my visit to the Island in 1962, recommendations were made for increasing production. Schools such as Malhaha were asked to develop citrus nurseries in the school gardens to provide planting material for the development of a special orchard on one of the few available areas of land. This land is stony, with numerous rocky outcrops, but with deep pockets of fertile soil between, supporting the existing dense jungle (which I found to my cost included *Laportea harveyi* (MAMALA).)

Yams (UHI), taro (PAPULA or AANA when prepared for the table), cassava (TAPIKO), sweet potatoes (KUMARAS), bananas (PARI), plantains (MAMI), breadfruit (ULU), with too limited supplies of green food such as *Hibiscus manihot* (VATI), are common subsistence crops. A special strain of cassava is of interest and value in that it can remain in the ground after maturity for as long as two years.

Technique For Growing Giant Yams

Anyone wishing to grow yams much bigger than a man and win prizes at agricultural shows could not do better than follow the technique used by Rotuman yam growers. The results are a good example of the combined efforts of man and nature.

Numerous methods are used, two of which are very briefly as follows:

If great length is required, a round hole is dug to a depth of up to 10′. The width should be comparatively small; just wide enough to accommodate a yam of good size with a minimum weight of ten pounds. The hole is filled up with rotted vegetation, together with rich topsoil, care being taken not to break down the sides of the hole.

A large whole yam is then selected and all buds removed except one towards one end. Thus prepared, the yam is planted just below ground level, *not* in the previously-made hole but alongside it, in such a way that the end of the yam, with the bud thereon, protrudes into the centre of the hole, also just below ground level, and with the bud pointing downwards.

Surrounding trees are then cut down to rest on prepared wooden rails to form a natural trellis on which the vines are encouraged to climb. (Sometimes, of course, if the planting is done on open ground, an artificial trellis is constructed.)

If a yam of great width is the primary aim, the hole is made shallower (up to 4′) but much wider, otherwise the same method applies. Weights of over 200 lbs.—even up to 250 lbs.—have been obtained.

Pineapples (PONAPA), pawpaws (ESU), mangoes (MAGKO), water melons (MERENE), Tahitian chestnut (IFI), and *Sondias dulcis* (VI), provide welcome additions to the diet. VI is commonly shredded and mixed with coconut cream to make a refreshing dish.

Outside almost every house are racks with rows of husked nuts, "corked" at the top. These nuts are filled with seawater in place of the coconut water. They are left in the racks for a period of up to two weeks, depending upon the stage of maturity of the nut. The white, pulpy, fermented material is then scooped out of the nut and eaten with fish or other foods. This product is known as TAHRORO.

Orange juice is naturally a popular beverage, and fortunately the law against brewing of alcoholic liquor therefrom is strictly enforced. There is some coffee on the island, and kava is also produced, although the latter is only used on special occasions for marriage and other ceremonies.

Small cocoa plantations are established between the coconut palms, as on Taveuni and other islands of Fiji.

To provide more vegetable proteins in the diet, leguminous crops such as peanuts, cowpeas, mungh, and improved strains of successive flowering pigeon peas could be introduced with advantage for health, soil fertility, and to permit of the following of at least a form of crop rotation.

Pest Control

The people are against spending money on chemicals for the direct control of pests of subsistence crops, and it will take time and patience to prove to them the overall economic benefits resulting therefrom. In the meantime, plantation sanitation, good general husbandry, and biological control methods

offer the only alternatives. However, the Field Assistant was advised to keep on hand at the Government station a limited supply of D.D.T. and dieldrin, which are, of course, inexpensive.

I observed that the leaves of some taro were attacked by cluster caterpillar (larvae of *Prodenia litura*) and by the larvae of the hawk moth (*Hippotion celeria*). Serious flare-ups of trouble have occurred elsewhere from such pests; hence the need to have some D.D.T. on hand.

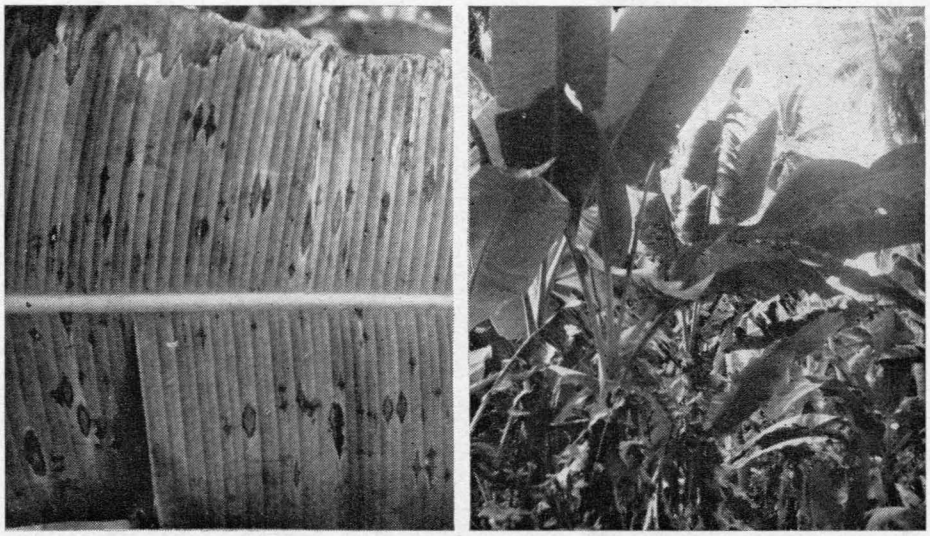
The need for dieldrin will be apparent from what I am about to say concerning pests of bananas. In 1952 the people became very alarmed at the widespread losses suffered from what was thought to be a mysterious new disease of bananas. Although it is true that black cross spot disease—*Dothidella musae*—is apparently new to the island, this was a minor contributory factor, the main trouble being the ravages of the banana weevil borer (*Cosmopolits sordidus* Germ.), which had obviously been multiplying rapidly until at present there are very few plants free of them. This is all the more tragic considering the comparative ease and cheap cost of combating this pest, providing dieldrin is used along with the other accepted methods of control, and it is hoped that as a result of advice given, the position will improve in certain areas. However, in view of what has already been said, supplies of Jepson's beetle (*Plaesius javanus* Er.) have been shipped at my request to Rotuma, and liberated. These beetles eat the larvae of the weevil borer, thus breaking the life cycle.

Bunchy top virus disease, Sigatoka disease, and banana scab moth are all well represented, and this probably also applies to nematodes. Little attention is given to proper husbandry, or even desuckering. A "bush" bird known locally as *kalae* does considerable damage to both taro and bananas—except to the blue Java variety of the latter, which it ignores.

Variety Of Livestock

There are some 500 cattle, over 200 horses and a few goats tethered in the rough undergrowth in the coconut plantations. There are also countless pigs running largely uncontrolled apart from the stone-wall fences. As would be expected, they are heavily infested with kidney worm and other internal parasites.

The incidence of tuberculosis in cattle and pigs is comparatively low, but common troubles are: choking caused by fruits such as mangoes, oranges, etc., injuries to various parts of the body due to tethering in rough bush, parturition difficulties, and sometimes dehydration. Fresh water shortage is a major problem, and although livestock have learnt to rely heavily on rainwater collected in the thousands of half-coconut shells littered around, they are brought to their nearest watering place about once a fortnight. The water in wells near the coast is not brackish, and they do provide some reserves during a dry spell when roof catchment tanks run dry.



Above: Banana leaf attacked by black cross spot disease. Right: Typical neglected banana "grove".

Sometimes this fortnightly chore is forgotten, and Field Assistant Kafoa told me of a case of an ailing cow he was called to see. The owner related how the animal had been getting weaker and weaker until near death. Questioning revealed the fact that the animal had not been brought up for watering for months, and when this was corrected, the animal made a rapid recovery.

Poultry run uncontrolled around the villages and nearby areas. Like all the stock they are mongrels, but nevertheless are comparatively healthy, although there are at times odd outbreaks of fowlpox, particularly of the type commonly known as roup.

Fortunately there are no mongooses or hawks to contend with on Rotuma, but rats often kill chickens in addition to destroying whole plantations of watermelons and pineapples. Just before dark one evening, I was sitting talking to a Rotuman friend when a large rat appeared stealthily creeping up towards some chickens which had strayed behind the mother hen. Owning a gun and being a good shot, he quickly disposed of the rat, but, as he said, with the high cost of ammunition, it was probably an expensive way of dealing with them, particularly had he missed. Indeed, warfarin poisons would be more economical and more effective.

I am informed that there is spring water on one of the nearby tiny islets, and consideration is being given to the possibilities of bringing this to the main island. The high land in the interior also suggests the possibility of constructing a reservoir from which fresh water may be gravity-fed to all parts of the island, if ever sufficient funds become available to finance such a comprehensive project.

Proposals For Livestock Improvement

As in most Pacific Islands, this and other obvious needs for livestock improvement—notably, good housing and water supply both to houses and pastures, regular supplies of animal foodstuffs of the right kind, adequate fencing, good breeding stock, and overall good management—are lacking. However, indirect help can be given by introducing new blood, particularly well-bred sires to mate with the local stock.

A recommendation made during my visit in 1962 was that 42 cockerels—preferably Rhode Island Reds—should be bought, one for each village. It was further suggested that the stock should be purchased from the Koronivia Research Station or from a reputable farmer. Again, funds permitting, this idea could well be extended for cattle and other livestock.

Folding and rotating pigs on plots of cassava, as at Koroniva, but using coconuts and pulse crops as a second best only to unavailable skim milk, would in my opinion be worth trying in spite of the lack of animal protein—but providing, of course, that new, good foundation stock are introduced, and providing fresh, well-drained land is made available.

As would be expected from what has been said about pigs, coconut shells, etc., there are swarms of flies and mosquitoes with all the associated discomforts these pests cause to everyday life. They certainly tend to dispel one's initial impressions of a South Sea Island paradise. Several introductions of a predator of flies (*Platylister chinensis* Quens) have been tried, but unfortunately without any really noticeable effects.

The problem for unscreened houses

(Continued on page 63)

Meteorological Conference In Noumea

Mr. Giovannelli, chairman of the Conference, addressing the opening session.

The third session of the Region V Association for the South-West Pacific of the World Meteorological Organization was held in Noumea from November 5-17 last.

AT the invitation of the French Government the third session of the Region V Association for the South-West Pacific of the World Meteorological Organization was held in Nouméa from November 5-17 last, in rooms provided by the South Pacific Commission at its headquarters at Anse Vata.

The Conference was attended by some thirty participants and was honoured by the presence of Mr. André Viaut, Director of the French National Meteorological Office who for eight years has been the President of the World Meteorological Organization.

Nineteen delegates represented the member countries of Australia, the United States of America, Indonesia, French Polynesia, Singapore and the British Territory of Borneo, Malaya, New Caledonia, New Zealand, and the Philippines.

The Conference was also attended by representatives of the World Meteorological Organization's secretariat and by observers sent by various international and other organizations including the International Civil Aviation Organization, the International Council of Scientific Unions, the International Federation of Airline Pilots and the French Institute of Oceania.

The Conference

The Conference was formally opened on November 5, in the presence of His Excellency Mr. L. Péchoux, High Commissioner for the French Republic in the Pacific. Mr. J. Giovannelli was chairman.

Two working committees were appointed, one to study matters concerning operations, and the other, matters related to technical planning and development.

The wide variety of items submitted to these committees included a survey of the network of meteorological stations for surface and altitude observations, the use of automatic stations in uninhabited areas, the use of radar in meteorology, ozone and radiation measurements, coding, telecommunications through radioteletypes and facsimile, the programmes of technical assistance for training staff and the extension of modern methods, marine meteorology, the protection of jet planes flying at high altitude, the practical interpretation of data transmitted by artificial satellites, the various practical uses of meteorology and in particular assistance to agriculture.

This last question—as one of great practical importance—was the subject of a statement by the Australian delegation. The speaker explained the operation in Australia of services specialized in this field.

An information service provides farmers with data concerning the growth of plants, the propagation of insects and plant diseases together with information on the rainfall, temperature, wind, and evaporation.

An advisory service interprets the meteorological data for farmers for any given problem. Some of these problems

Mr. T. R. Smith (left), Secretary-General of the South Pacific Commission, with (l. to r.) M. Andre Viaut of France, President of the World Meteorological Organization, Mme. Viaut, and Mme. and M. Giovannelli of New Caledonia.

can be dealt with easily and efficiently whereas others require lengthy research, such as the important climatical studies undertaken to investigate the best use of different agricultural areas.

Finally, an "Advisory Centre" prepares weather forecasts for general or for particular purposes, 24 hours in advance and in some cases even 2-4 days in advance, such as those for harvests.

Resolutions And Recommendations

Some thirty resolutions and recommendations were adopted on the various subjects which were discussed, particularly the carrying into effect of modern methods. Permanent working groups were appointed to follow up the development of the various problems in the region until the next session is held.

The chairman and vice-chairman of the Association for the four-year recession were appointed at the closing meeting.

Mr. J. L. Giovannelli, Director of the Meteorological Service in New Caledonia, was elected chairman, and Mr. W. J. Gibbs, Director of the Australian Meteorological Service, vice-chairman.

Finally, on behalf of his country the senior representative for Indonesia, Mr. Sutrisno, invited the Association to hold its fourth session in 1966 at Djakarta.

Agriculture On Rotuma Island

(Continued from page 61)

and other buildings may perhaps be solved by use of the latest insecticidal varnish produced in Denmark. This varnish, it is claimed, not only kills any flies which come in contact with it but also kills any in the vicinity, by means of a minute quantity of gas which is slowly emitted and which is unnoticeable.

* * *

My final impressions of Rotuma were of a glorious sunset and a large gathering of her happy, kind and friendly people waving a farewell as the last ship's boat pulled away from the shore, loaded from stem to stern with cases of the famed oranges and coconuts destined for friends and relations in and around Suva. Who would not wish to return one day to such an island, so full of interest and beauty?

ACKNOWLEDGEMENTS

I wish to acknowledge assistance obtained from the Fiji Department of Agriculture files, including reports from Field Officer Kafoa Fakvai, also guidance in completion of the map of Rotuma by reference to W. Eason's *A Short History Of Rotuma.*

SPC Entomologist Attends Pacific Science Board Meeting

Dr. Charles P. Hoyt, the Commission's entomologist, left headquarters on February 20. He spent one day at Suva, Fiji, for consultations with Mr. B. A. O'Connor, the Commission's consultant on matters relating to plant and animal quarantine. Dr. Hoyt then continued on

to Honolulu, Hawaii, to attend, as representative of the South Pacific Commission, the Pacific Science Board's meeting of the Invertebrate Consultants' Committee for the Pacific on March 1 and 2.

Dr. C. E. Pemberton, of the Experiment Station of the Hawaiian Sugar Planters' Association and a member of the SPC Rhinoceros Beetle Technical Advisory Committee, was Chairman of this meeting, which entomologists from the U.S. Trust Territory of the Pacific Islands, French Polynesia, Guam and Fiji also attended. The current status of insect pest problems in the area were reviewed and the best measures for combating them were discussed.

The meeting provided an excellent opportunity for Dr. Hoyt to consult with the leading specialists in this field on the Commission's research programme on rhinoceros beetle control.

From Honolulu, Dr. Hoyt proceeded to Singapore and the Malayan sub-region where he will continue his search for predators and parasites of *Oryctes* and other related species. It is expected that Dr. Hoyt will remain in this region for approximately six months.

Agricultural Extension Courses At Queensland University

The University of Queensland has invited attention to the one-year post-graduate diploma course in agricultural extension introduced in its Faculty of Agriculture in 1963. The course is open to any graduate, and it is expected that graduates in agricultural science, agricultural economics, veterinary science and pure science will be represented among those who enrol.

The teaching of agricultural extension is a professional field of practice involving advanced training and practical experience. The University considers that diplomates from the course will be equipped to play the rôle of professional extension educationists who will lead and conduct extension programmes, undertake research in the field, and contribute to policy which would lead to more extension work in rural communities.

At the request of the University, the economic development section of the South Pacific Commission is distributing copies of the University's brochure on the diploma course. From the details of the course set out in the brochure it is clear that it aims at providing a theoretical background for those concerned with developing extension policy for specific conditions. It would seem also to be particularly appropriate for those responsible for training personnel in the lower echelons of agricultural service.

Enquiries about the course should be directed to Dr. Joan Tully, Department of Agriculture, University of Queensland, St. Lucia, Brisbane, Queensland, Australia.

SPC Literature Production Training Centre Closes

(Continued from page 45)

they had brought to a small community. He went on to speak of the arrangements under which the UNESCO equipment of the Centre was to be transferred to the BSIP Government and the Centre become the Protectorate Government Printing Office. Under these arrangements a limited number of trainees would be accepted from other territories for training in the print-shop. At the conclusion of his speech, Sir David presented each trainee with his certificate.

Trainees Express Thanks

Speaking on behalf of all the trainees, Ben Whippy of Fiji then addressed the gathering:

"Your Excellency the High Commissioner, on behalf of the trainees I would like to thank you for including this presentation of certificates in your already crammed programme. We are indeed honoured to have you present us our certificates and I am sure that the trainees will all agree with me most heartily. When we leave here we shall be prepared to face whatever is expected of us back home with the knowledge we have acquired during the year.

"I would also like to thank all those who are present here this afternoon. I can assure you that your presence here has made this quite an occasion for us, and I hope that when you leave here you will take with you a good impression of the work we have done during the year.

"I guess it's not too early to also take this opportunity to thank those who went out of their way to make our stay here a pleasant one. Without them our time here wouldn't have passed away as quickly as it did. We have enjoyed meeting and knowing you and we do hope that we will be able to repay your kindness if you happen to come to our islands.

"I shall also thank Mr. Marriott, Mr. Koenen and Monsieur Poggi for the tremendous help they gave us during the year, and especially for being so patient with us. Thank you very much.

"Before I take my seat I would like to thank His Excellency the High Commissioner once more for his presence here today. And now I shall ask the trainees to show their appreciation in joining with me in a hearty clap".

Display Of Work

Following the speeches, guests were invited to inspect a display of samples of the various types of printing done during the Centre's three years. These included books, posters, news-sheets, brochures, maps and letterheads, and left no doubt, as Sir David Trench had mentioned, of the success of the courses of instruction.

New SPC Boatbuilding Courses For Islanders

TWO new South Pacific boatbuilding courses were inaugurated during March and April. The first opened at Auki in the British Solomon Islands during the week commencing March 11. This is the second course to be held at Auki. The first, held there from 1960-1962, proved so successful that it inspired a second course there and a third one at Nouville in New Caledonia. The latter is scheduled to open around mid-April.

Thirty-two trainees will take the new Auki Course. Twenty-four will be attending for the first time, while another eight from the original course have returned for more advanced training. Territories represented are the British Solomon Islands, Gilbert and Ellice Islands, New Hebrides, Papua and New Guinea, Niue, Trust Territory of the Pacific Islands, and American Samoa. Five other new trainees have been nominated from outside the Commission area by the United Nations.

Thirty Trainees At Nouville Course

The Nouville Course will be attended by twenty-seven French-speaking trainees from New Caledonia, French Polynesia, Wallis and Futuna Islands, and the New Hebrides. One French-speaking candidate from outside the area, nominated by the United Nations, will also attend. The Course will be held in new buildings specially constructed for the purpose within the precincts of the Accelerated Professional Training Centre at Nouville.

As with the original Auki Course, the two new courses were initiated by the South Pacific Commission. They have also received substantial support from the United Nations Technical Assistance Bureau and the Governments of the two territories in which the Courses are based.

The aim of the Courses, which will again last two years, is to stimulate the development of the boatbuilding industry throughout the region. Instruction will be given in boatbuilding, fitting and maintenance of small diesel engines and general boat maintenance and repairs.

The Government of the British Solomon Islands Protectorate has already placed firm orders for four vessels to be built at Auki, and similar orders are expected from governmental and other organizations within the French territories.

SPC Study Group On Developing Small-Scale Private Enterprise

"The Development of Small-Scale Private Enterprise" was chosen as the topic for discussion and a programme of field visits by a sub-regional study group which met at Honiara in the British Solomon Islands Protectorate on March 6. Following a week of discussion and visits to places of interest in the Solomons, the group proceeded to Rabaul, Lae, and Port Moresby in Papua and New Guinea, where they undertook a further programme of observation visits and discussions. Enterprises inspected in Papua and New Guinea included furniture shops, co-operative associations, markets, cocoa fermenteries, private trade stores, and other business ventures conducted by indigenes.

Participants in the group included George Kalkoa (New Hebrides—British); Alick Swallow (New Hebrides—French); James Ategan Bop, Eric Nimrod Akken (Nauru); Eusebio Rechucher, Raleigh George (Trust Territory of the Pacific Islands); Joe Konihaka, Arnom Wadili (British Solomon Islands Protectorate); A. S. Rissen, Raga Magini, Peter Pako (Papua and New Guinea).

The study group was under the direction of Mr. R. H. Boyan, SPC co-operatives specialist.

PACIFIC READING

Material in this section is contributed by the South Pacific Commission Literature Bureau. Any enquiries relating thereto should be directed to BOX 5254, G.P.O., SYDNEY, AUSTRALIA.

Literature Bureau Publications

THE KUIARO BOOK. In "Notes and News" for July, 1962, reference was made to a three-part manual entitled *The Kuiaro Book—a Story of Agricultural Training* being prepared for the Department of Agriculture, Stock and Fisheries, Port Moresby. The first two parts of this publication have now been printed, and the final part is nearing completion. Written by Mr. W. Cottrell-Dormer, a former senior Agricultural Officer in the territory, these books relate in simple narrative form the work and activities undertaken by trainees at Kuiaro, a Departmental training centre. Apart from their value as an instructional manual of agricultural practices, it is hoped that these books will also help the trainees to develop a much broader outlook in rural matters and some appreciation of the vital importance of agriculture to the development of their community and their country.

Specimen copies of these books, together with details of production costs, are available from the Literature Bureau. Enquiries from territorial administrations or missions interested in the production of similar types of books will be welcomed by the Bureau.

WEALTH FROM THE COCONUT. The price of this book has been changed to A.2/6 per copy, plus postage, with a discount of 25% being granted on all orders for 12 or more copies. Orders for this publication should be sent direct to the Commission's Literature Bureau in Sydney.

Reprints—Bureau Publications

In response to requests from territories, the Literature Bureau has now arranged for a reprint of the following publications. Single copies of these books are available at the prices indicated, plus postage, whilst a discount is granted on all orders for twelve or more copies. Enquiries and orders should be sent direct to the Literature Bureau, Box 5254 G.P.O., Sydney, N.S.W., Australia.

A JUNIOR HEALTH READER (E. P. W. Marriott). Price A.3/- per copy.

This is an 80-page elementary hygiene book suitable for school use at about Standard V level of English. Although primarily intended for use in Melanesian areas, this book has also been found useful in other areas where health education is being practised.

Within a vocabulary of some 700 words, plus a further 50 medical terms, the author details the essentials of village and personal hygiene and describes such pests as flies, mosquitoes, bed-bugs and fleas; such infections as boils, scabies, sores and ulcers; such diseases as dysentery, malaria and yaws; in each instance practical preventive measures are explained. The text is illustrated with clear line drawings, and a set of review questions and exercises is included at the end of each lesson.

NATURE STUDY BOOK (Sheila Jamieson). Price A.3/- per copy.

Written in simple English, and illustrated with many ex-

cellent line drawings, this text is intended to provide children in the primary classes with a simple but factual introduction to the subject.

Topics covered include: Living and Non-Living Things; Plants, Leaves, Flowers, and Seeds; Sea Anemones; Coral and Coral Animals; Jellyfish; Starfish; Shells; Insects; Fishes; Reptiles; Birds and Mammals.

Attractively produced with a two-colour cover, this book contains 51 pages measuring 10″ x 7½″, and is bound with a spiral wire coil which enables the pages to be opened out flat.

THINGS TO DO IN WOMEN'S CLUBS (Books 1-4). Price A.2/6 per copy; set of 4 books A.7/6.

This series was originally prepared by the Women Welfare Officers, Department of Native Affairs, Port Moresby, to assist club leaders in planning their club activities. Each of the four books covers a three-month period of the year, and the material is presented in the form of weekly meetings, providing information on correct club procedures, health and homecraft talks, things to make and do, games to play, and other matters so essential to a well-run club.

The books are attractively printed in two colours, and the text is well illustrated with many line drawings. Although based on Melanesian conditions, the material can be readily adapted to suit other areas, and we feel sure that all club leaders and organizers of women's clubs will find them a valuable guide.

Literature Bureau Services

In addition to arranging the production and publication of books and other materials, the Literature Bureau provides several other services for assisting the provision of literature in the territories. Briefly these are:

MANUSCRIPT ADVISORY SERVICE: Territories quite often need to get certain reading materials produced for their own requirements but do not have the necessary printing resources or personnel to handle them within the territory itself. Although in some cases this material may be of such localized application that it is outside the scope of the Bureau to produce it as a regional publication, nevertheless the Bureau is still able to examine the manuscript, to offer sug-

gestions for its layout and production, and to obtain quotations from printers and publishers for producing it.

This information is then sent to the territory concerned, which is able either to follow it up on its own initiative or to ask the Bureau to handle the work on its behalf and at the territory's expense.

LIBRARY AND INFORMATION SERVICE: The Bureau maintains an extensive library of simple reading materials which have been prepared in many parts of the world for areas which experience literature provision problems somewhat similar to those in the Pacific. Information can be supplied appraising the simple books available on most subjects, and it is usually possible to arrange for inspection copies to be sent to education institutions and government departments.

ANCILLARY SERVICES: There are many different aspects of the literature provision problem and the Bureau has information available about many of these, such as the stocking and running of small static libraries; the use of mobile libraries and book vans; the organization and stocking of small bookrooms and bookshops; and the functioning of literature committees.

The Bureau can also offer advice about the types of printing equipment suitable for use in small establishments for the production of pamphlets and booklets. It should perhaps be mentioned here that, apart from mimeograph machines, equipment for printing is neither particularly cheap nor simple, and it is inadvisable for the inexperienced to embark on the establishment of a printing plant without very careful prior investigation into costs and the requirements for satisfactory plant operation and maintenance.

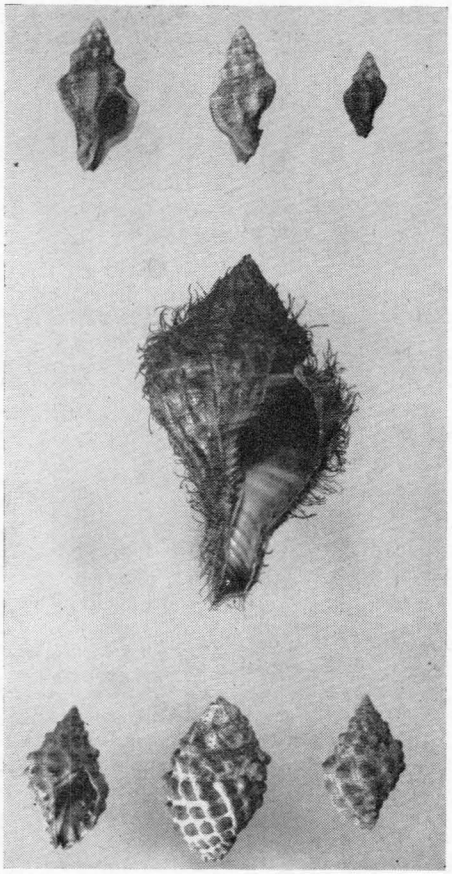
Visual Aids

PEANUT POSTER. The Literature Bureau has produced on behalf of the Health Education Council of Papua and New Guinea, a four-colour poster to encourage the use of peanuts in the local diet. Measuring 17″ x 13″, and attractively printed in red, brown and black on a pale green background, the poster depicts a Melanesian nursing mother cooking peanuts, and carries the caption "Eat Peanuts".

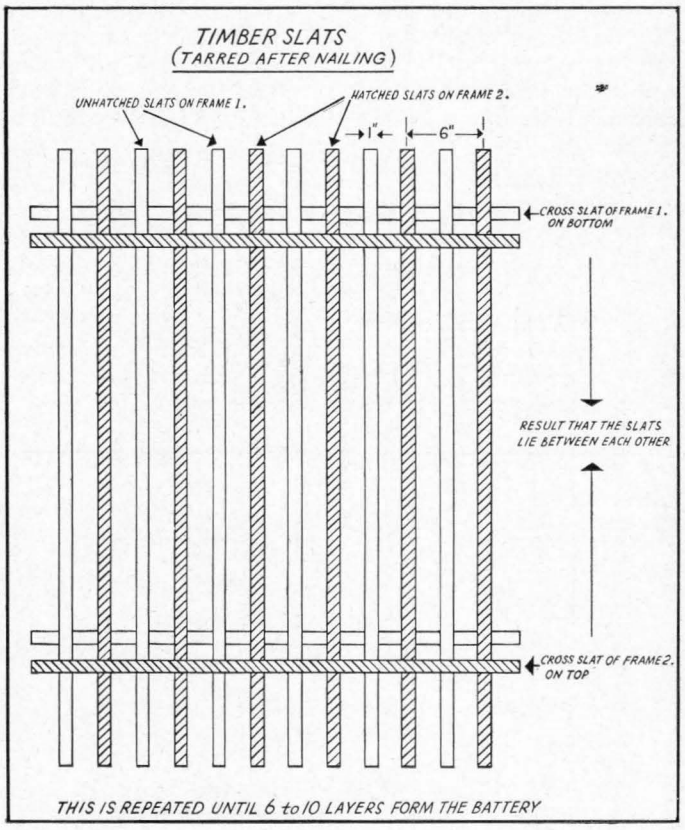
An inspection copy of this poster with details of production costs is available from the Literature Bureau, Box 5254 G.P.O., Sydney, N.S.W. The Bureau will also welcome enquiries from territorial administrations requiring advice or assistance in the preparation of materials to suit their own needs.

Miscellaneous

BINDING FOR PAPER BACK BOOKS. The rapid deterioration of paper-bound books is usually a problem in most island areas. For Penguin, Pelican, Pan, and other paper-bound books of similar size it is now possible to buy simple binding outfits which can be used without any previous experience of binding. These outfits, known as "Bind-Your-Own Book Covers," are produced by Bind-Your-Own Ltd., 22 Charing Cross Road, London, WC2, for stg. 7/6 a set. Sufficient material is supplied in each set to cover six books; the outfits including cloth cover-boards, spine cloths, end papers, glue, and paper for gold lettering. For one book, the whole operation of removing the original paper covers and placing on the new boards and end papers can be performed in about ten minutes.



Oyster pests. Top — tingle whelk; centre— hairy whelk; bottom— mulberry whelk. All are common borers of tropical and sub-tropical oyster reefs.



This sketch shows how a battery of frames is made up from tarred timber slats.

Oyster Farming

(Continued from page 52)

should not be put out too soon before the time the oysters spawn, because the cultch becomes fouled with seaweed and sand, and will not catch. And always there should be a reserve stock of oysters which can breed and carry on the species. Too heavy a harvest can deplete a fishery, as has been seen too often.

Oyster farming provides a means of producing an increased number of oysters of the best possible quality. Conditions vary from place to place, and only experience can teach what methods are best for each situation, but the methods I have so briefly outlined here have been found practicable and profitable in the great oyster industries of the world.

SUGGESTED READING

Handbook for Oyster Farmers. C.S.I.R.O., Australia, Division of Fisheries. Circular No. 3, 1954.

Oyster Farming in the Maritimes. Fisheries Research Board, Canada, Bulletin No. 131.

Oyster Cultivation in Britain. Ministry of Agriculture, Fisheries, and Food, 1956.

Oysters. C. M. Yonge, The New Naturalist Series, Collins, London.

SPC Conference On Rural Health

Special emphasis will be placed on maternal and child health at a conference on rural health that, at the invitation of the Government of French Polynesia, the South Pacific Commission will convene at Papeete, Tahiti, from April 18-27. At least twelve territories in the Commission area will be represented.

The agenda will cover discussions on rural health services, maternal and child health programmes (including technical problems related to weaning foods), immunizations, anaemia, obstetric services, and school health.

Two eminent authorities have been engaged as consultants for the Conference. They are Dr. N. R. E. Fendall, M.D. (Lond.), B.Sc., D.P.H., Director of Medical Services, Kenya, who is an expert in the field of rural health services, and Dr. Wiktoria Winnicka, Director of the Maternal and Child Health Division, World Health Organization.

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Copies of SPC Technical Papers, which as a general rule are published both in English and French editions, may be procured from the South Pacific Commission, Nouméa, New Caledonia, or G.P.O. Box 5254, Sydney, Australia. Except where otherwise stated, price per copy, post free by surface mail, is 2/- stg. (2/6 Aust., 2/3 Fijian, 30 cents U.S.).* The letters "E", "F", or "EF" in parentheses at the end of each listing indicate present availability of titles in English and/or French editions.

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23. **Nutrition Research Conducted in New Hebrides during 1951.** Sheila Malcolm. April 1952. (E).
50. **Nutrition Investigation in New Caledonia.** Sheila Malcolm. October 1953. (E).
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83. **Diet and Nutrition in the Trust Territory of the Pacific Islands.** Sheila Malcolm. July 1955. (E).
95. **Bibliography of the Nutritional Aspects of the Coconut.** F. E. Peters. September 1956. (EF).
100. **Chemical Composition of South Pacific Foods—An Annotated Bibliography.** F. E. Peters. January 1957. (6/- stg., 7/6A., 6/9F., $0.90). (EF).
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PUBLIC HEALTH

12. **Tuberculosis Investigations by the South Pacific Commission in 1950.** May 1951. (EF).
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27. **A Survey of Leprosy in the British Solomon Islands Protectorate.** Dr. C. J. Austin. July 1952. (EF).
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131. **Dental Health in South Pacific Territories.** P. B. Cadell. August 1960. (EF).

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17. **Conference of Experts on Filariasis and Elephantiasis, Tahiti: Summary of Proceedings.** September 1951. (EF).
33. **A Survey of Malaria in the British Solomon Islands Protectorate.** Dr. R. H. Black, November 1952. (EF).
61. **Malaria in the Trobriand Islands.** Dr. R. H .Black. May 1954. (E).
65. **Annotated Bibliography of Filariasis and Elephantiasis.** September 1954. (5/- stg., 6/3A., 5/6F., $0.75). (EF).
66. **Distribution of Filariasis in the South Pacific Region.** Dr. M. O. T. Iyengar. September 1954. (5/- stg., 6/3A., 5/6F., $0.75). (EF).
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14. **Educational Broadcasts to Samoan Village Schools.** Department of Education, Western Samoa. May 1951. (EF).
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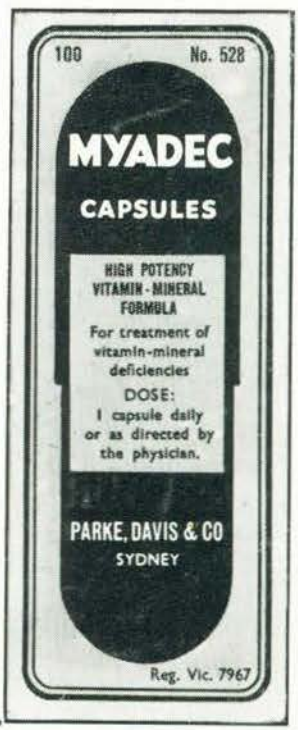

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